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WORLD PETROLEUM

Practical Application of Stabilization • Novel Features In New Canadian Refinery • Jersey Standard's Great Oil Fleet • Colombia's Oil Law Hampers Development • Petroleum's Influence Upon Shipbuilding • Selecting Oil Tanker Propelling Machinery • French Oil Import Licenses

NOVEMBER • 1931

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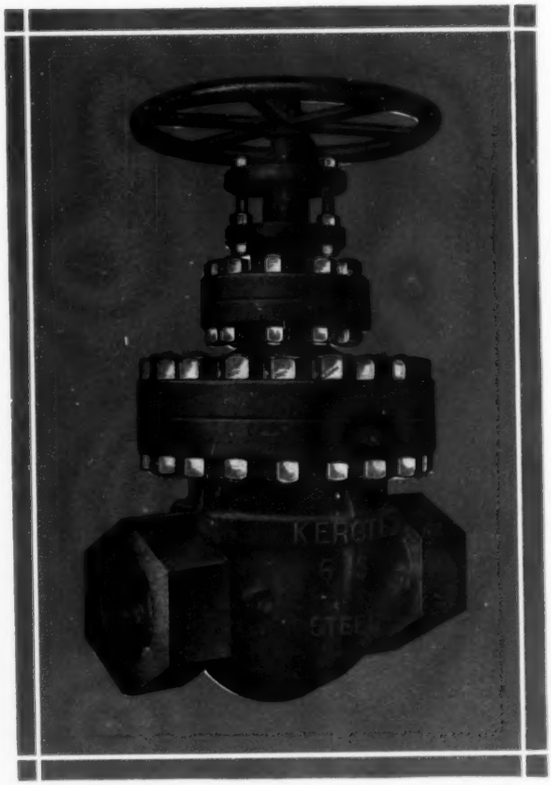

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NOVEMBER
1931

WORLD PETROLEUM

(Incorporating "Petroleum Equipment Exporter")

VOLUME II NUMBER 11

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PUBLISHED MONTHLY BY

RUSSELL PALMER

153 Waverly Place, New York, U. S. A.

Telephone: SPring 7—7398

Cable Address: Ruspam, New York

Executive-Editor, T. Orchard Lisle

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▼

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California

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Cable Address. Ruspam, Los Angeles

Manager, F. S. Norman

Subscriptions

ANNUAL subscription to WORLD PETROLEUM is offered at the flat rate of five dollars (U. S.) postpaid to any country in the International Postal Union, except in Canada where a special tax compels the publisher to charge $5.60.

For the convenience of subscribers the publishers will accept payment in any of the following currencies at the fixed rate shown below:

Argentine	14 paper dollars
Canada	5.60 dollars
Colombia	5.25 peso (gold)
France	130 francs
Germany	21 Reichsmark
Great Britain	One guinea
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Peru	1.25 libra
Poland	45 zloty
Rumania	835 lei
Russia	1 chervonetz
Venezuela	25 bolivar

Remittances or drafts to the order of the Publisher, WORLD PETROLEUM, payable in New York and London.

Subscriber's name and address should be in Roman capitals on the subscription order.

Official position of subscriber is requested.

Advance notice, if possible, of a change of subscriber's address should be given. Effect cannot be given at once to a change of address. The period of transmission of the subscriber's instructions through the mail extends the time required before the magazine can be mailed to the new address.

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SINGLE copies of WORLD PETROLEUM are obtainable every month, within the delay imposed by the international mail service, at any of the following agencies:

CABIMAS, VENEZUELA—The German Store
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NEW YORK—Telephone SPring 7-7398 for list of 20 newsstands carrying copies
PARIS—Librairie Brentano, 37 Avenue de l'Opéra
PORT OF SPAIN, TRINIDAD—Davidson & Todd, Ltd., 8 Frederick St.
RANGOON—British Burma Press, 48-51 Sparks St.
TAMPICO—La Sonora, S. A., 25 Comercio Oriente

The price of a single copy is 55 cents in Canada, 2 shillings in other countries of the British Commonwealth and the equivalent of 50 cents (U. S.) elsewhere.

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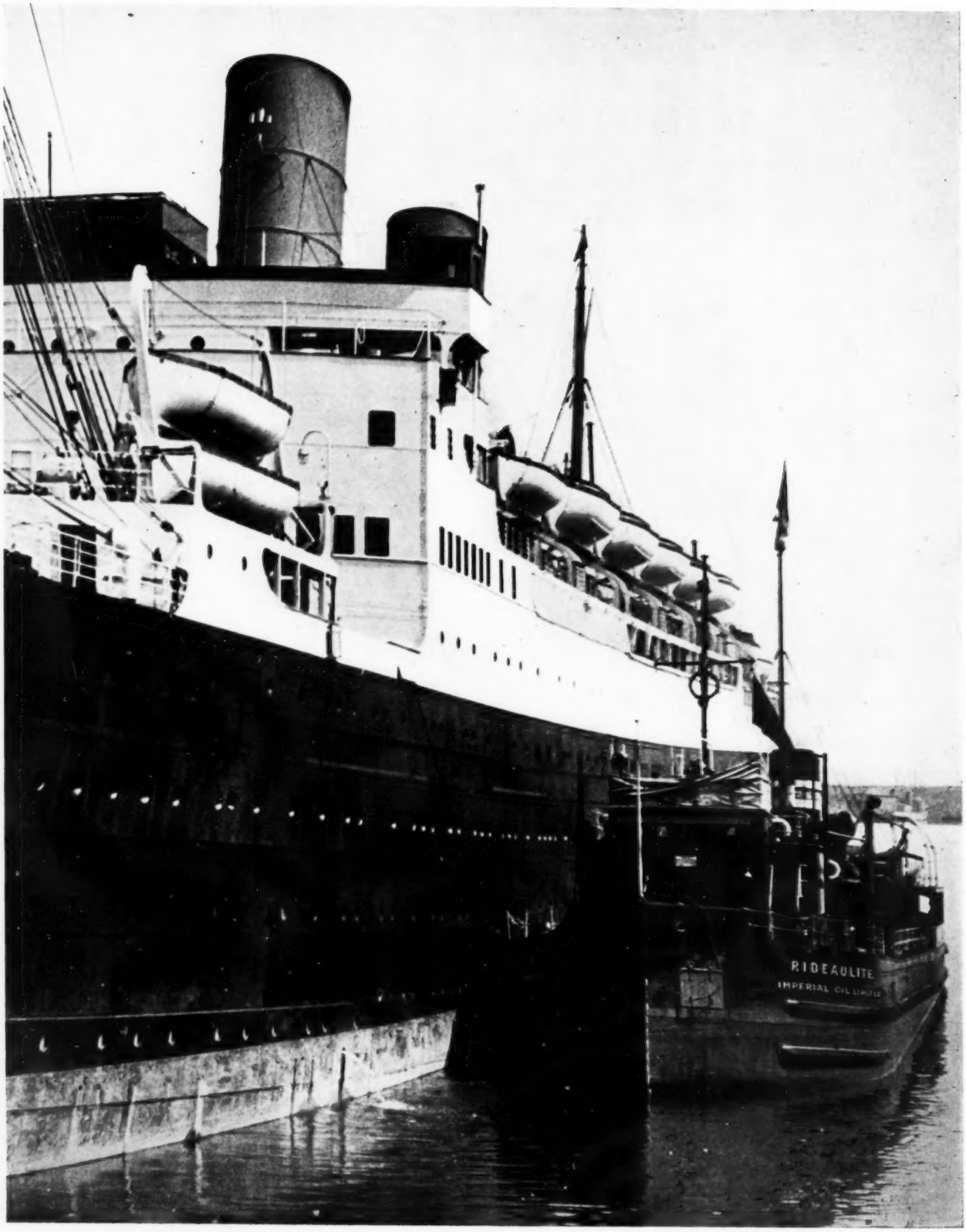
Advertising rates are scheduled in Standard Rate and Data. Copies of the schedule can be obtained on request to the Advertising Manager, 153 Waverly Place, New York, N. Y., or to 110 Fenchurch St., London, or to Bendix B'ldg., Los Angeles, Cal.



"Feeding" an Ocean Giant with Oil.

NEW YORK • WORLD • LONDON

PETROLEUM

A. P. I. Meeting

BECAUSE of the number and gravity of the problems confronting the petroleum industry at the present time the annual meeting of the American Petroleum Institute which is to be held in Chicago, November 10-12 is likely to be of more than usual interest and importance. The value of this yearly gathering is not confined to the set papers and discussions scheduled on the regular program but is enhanced by the opportunity afforded to leaders of the industry to exchange views and this informal interchange of opinions gains in importance in ratio to the completeness with which different sections and different groups of operators are represented at the convention.

Recognition of the urgent need of arriving at some effective plan of stabilization is bound to assign a leading place to this topic both in the formal and informal discussions which take place at Chicago. It will receive attention at two of the general sessions in addresses by Oscar Sutro of the Standard Oil Company of California on the anti-trust laws in relation to natural resources and by Judge C. B. Ames of The Texas Company on the subject of agreement among the oil producing states to insure uniformity in conservation laws and their administration. No doubt the same topics will come up for consideration in committee meetings and unofficial conferences. It is high time for a crystallization of views among the members of the industry on this all important matter and the Institute meeting will perform a public service if it contributes to progress in this direction.

Another problem that has come to the fore since last year's meeting is that of gasoline tax evasion. This question and the importance of uniform state tax laws as an aid to the prevention of evasion will be brought up for discussion in the general session on marketing and also in the meetings of the committees dealing with these subjects. The Institute is to be honored by the presence at the annual dinner of Secretary of Commerce, Lamont. While the subject of his address will not be announced in advance it undoubtedly will contain constructive suggestions for the petroleum industry and will be received with close attention to any message it may convey as to the attitude of the federal administration toward the problems that are giving serious concern to the members of the industry at the present time.

State Oil Control

POSSIBILITY of an early pronouncement by the Supreme Court of the United States on the question of the latitude which state legislatures may employ in regulating the production of oil by private producers is contained in the fact that three important cases involving legislation by each of the three most important oil producing states of the American Union either are now before that body or on the way to presentation before it. While these actions all hinge on laws directed against the waste of natural resources the scope of the laws and the bases of the attacks launched against them differ somewhat so that the Court may possibly uphold the validity of one or more of these laws while disapproving others. In any case its decisions when rendered should aid in determining the lines along which future efforts in the direction of state regulation shall proceed.

Of the three cases the one originating in California involves the validity of the law prohibiting the wastage of natural gas which has been made the basis of efforts to apply conservation in that state. In Oklahoma the law not only forbids waste but is broadened to include a prohibition of production at a time when there exists no market demand at a price equivalent to the "actual value" of the product. It is anticipated that the claim will be advanced that this is in effect a price fixing provision and the Court will exercise its judgment in deciding whether the inclusion of this feature is an unwarranted exercise of state authority or whether it is merely an elaboration of the primary purpose of conservation.

The recent attempt to enjoin the Texas Commission's proration orders issued as a means of preventing economic waste may lead to another appeal to the country's highest tribunal in which case the Court will have an opportunity to declare whether it is within the province of a state to prevent merely physical waste of its natural resources or whether it may extend its action to prohibit economic waste through the sale of products at unprofitable prices.

Whatever may be the conclusions of the Court an early decision on the issues involved will be welcomed by state officials and by the members of the petroleum industry because it will indicate with some degree of definiteness the procedure under which state regulation of oil can be carried on and pave the way to stabilization.

Is a "Czar" Needed?

WHENEVER internal difficulties arise in an American industry one proposal that is certain to be advanced is the appointment of a "Czar" by which is meant the selection of some individual to serve as a sort of sublimated umpire with authority to hold members of the particular industry concerned to an accepted code of practice. From time to time the suggestion has been advanced that the petroleum industry would benefit by setting up such a functionary and recently the newspapers have published reports that the post was to be offered to Vice President Curtis. While the institution of a supreme authority appears to have worked fairly well in professional baseball and in the motion picture industry there is serious doubt as to whether it would be acceptable or practicable as applied to petroleum. Certainly the title would be an empty one in the present state of the industry and would remain so unless or until some of the existing barriers to cooperative action were removed.

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Colombia's Onerous Law

WHEN the existing law governing the development of oil lands in Colombia was enacted early in the present year representatives of four leading companies owning extensive tracts of undeveloped land in that South American republic signed a statement in which they said:

"The provisions of the present bill, as it left the Senate, are so restrictive and uneconomic that, in the opinion of the undersigned oil company representatives, it is most probable that no new oil operations will be begun or developed under that measure if it becomes a law. So that, far from attracting capital and promoting the utilization of those natural resources, it will bring about their stagnation, affecting at the same time the general economic situation and postponing new revenues and benefits, both direct and indirect, which were expected from the oil industry."

At that time it was believed that some of the more onerous requirements of the measure which became known as Law 37 of 1931 would be modified later on. In fact, amendments to the law designed to meet some of the objections listed by the representatives of the oil companies were introduced in the Colombian Senate and House. Up to mid-October these amendments had not emerged from the committees to which they were referred and there seemed to be little likelihood of favorable action upon them by the Colombian Congress. So discouraging was the outlook for any change that would permit the companies to proceed with the work of proving and developing their fields that most of the official and operating staffs have been withdrawn, leaving only the few men needed to look after the property interests of the various organizations concerned.

One of the provisions of Law 37 to which chief objection has been raised is that which puts upon the company desiring to undertake development the burden of proving its title not only to the surface soil but also to any oil that may be beneath it. In case the title is questioned long delay and expensive litigation may result before legal ownership can be established and it is asserted that the procedure provided in such cases is contrary to the principles and the historic practice heretofore prevailing in Colombia. Numerous other sections of the law relating to taxation, royalties, free storage and transportation of government oil, while less objectionable than the provisions affecting ownership, are such as to prevent attempts at development under conditions now prevailing.

While the oil industry at the moment can well dispense with additional supplies of petroleum that might result from exploration and development in Colombia it is well understood among oil men that at least five years will be required before these operations can result in the actual marketing of oil. It is well within the range of possibility that by the end of that time the world will be looking for oil as eagerly as it now seeks means of halting its too abundant flow. In the meantime the action of Colombia in neglecting to rationalize a too rigorous law is driving out of the country interests that stand ready to spend millions of dollars in exploration and development, providing employment and creating business that are greatly needed in the country.

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Water Transport

MUCH of this issue of WORLD PETROLEUM is devoted to the more important phases and problems of marine transportation of petroleum and its products. Sea borne and inland waterway oil traffic is a colorful part of the world picture of oil. Including vessels under construction and now in service, the investment of oil companies and other ship owners represents over $1,000,000,000. This figure itself strikingly illustrates the importance of oil transportation by water as well as the vast extent of the movement of petroleum in national and international trade. Regardless of the high initial cost of the equipment required, water still forms the cheapest means of moving large quantities of oil in bulk.

Over twelve million tons deadweight of tankships are in service and building, apart from nearly eight million tons of oil barges. Today tanker owners are facing an unusual situation inasmuch as the temporary falling off in the international movement of oil is causing tankers ordered a year or more ago to meet the expected normal increase in world consumption to be laid up as completed, particularly those built by independent operators for charter. The volume of water borne oil moving into and out of the United States alone during the first eight months of 1931 decreased more than forty million barrels in comparison with the corresponding period of the year preceding. With the restoration of normal business conditions present surplus tonnage will find full employment and there may even be a shortage as only a small increase in annual consumption by the world's 32,000,000 motor vehicles will add a billion gallons to gasoline requirements. Another factor that may have a bearing upon the situation is the movement toward higher speed which is likely before long to lead to the building of faster vessels.

Should the movement for a tariff on oil or an embargo against imports into the United States be successful, one result would be the immediate construction of new American flag tankships for carrying fuel oil and gasoline from Californian and Gulf ports to the Atlantic Coast. The laws of the United States restrict the operation of coastwise service to American vessels and the number of these available is insufficient to transport the fuel oil required by the industrial districts and merchant shipping along the Atlantic Seaboard.

The average life of the modern tanker is not likely to be much more than ten years. This is particularly the case with gasoline carriers as the corrosion problem has not yet been solved. Replacements must average over a million deadweight tons annually without taking into consideration the possibility of additional requirements through any increase in the use of fuel oil and the lighter spirit. Consumption of fuel oil by commercial and naval ships represents a steadily increasing tonnage under normal trade conditions. In marine transportation coal has definitely been displaced by oil. This oil must be transported to bunker stations in every port.

Practical Aspects of Stabilization In U. S.

By E. W. Mayo

THERE are only two possible roads to stabilization of the petroleum industry in the United States. One is by voluntary agreement for the control of production and distribution, among the individual producers and handlers of oil the other is by involuntary cooperation to the same end through State laws and supervision.

The so-called anti-trust laws of the nation stand as a formidable obstacle in the first path. The Sherman act, adopted in an industrial era in which overproduction was a seldom occurring problem, declares that every contract in restraint of trade is illegal. Obviously an agreement to prorate production or distribution can be construed as an act in restraint of trade. In the light of past decisions it is probable that the Supreme Court would hold that it could not be construed otherwise.

It is possible that the spectacle of many great industries subjected to paralyzing losses by over-competition may induce Congress to modify the sweeping language of the anti-trust law. The inducement to do this is particularly strong in the case of petroleum where unrestrained competition involves not only ruinous losses to individuals and companies, but results also in a tremendous waste of one of the nation's great natural resources that cannot be replaced.

While this possibility exists it is certain that any proposal for a change in the present law will involve protracted debate and is likely to be long delayed. Even were agreements to control the production of oil, lumber and coal to be legalized when done to relieve a condition of overproduction as recommended by the directors of the United States Chamber of Commerce it is not certain that this would lead to stabilization in the petroleum industry. Conditions in the United States are such as to make a producers' agreement difficult to establish and of doubtful duration. In districts where control rests in the hands of a few large companies an undertaking of this kind may be made effective but with the multiplication of lease holders in some of the newly developed fields it is almost impossible to secure unity of action. Refusal to cooperate by even a small proportion of the producers is sufficient to wreck the most carefully drawn conservation plan.

From the points of view both of political feasibility and practical operation stabilization through the voluntary action of producing interests is so difficult under the circumstances existing in the United States that many practical oil men regard all schemes dependent upon such action as chimerical.

What groups of individuals cannot do without peril of the law the states of the American Union are empowered to undertake. True, the authority of the State is confined to the territory comprised within its own borders, but in the case of petroleum so much the greater part of production is within the limits of a few States that concerted action to attain a desired result need not be difficult. In 1930 Texas produced 32.3 percent of the entire crude output of the United States, California contributed 25.4 percent and Oklahoma 24 percent. These three States supply over 80 percent of the production of the country and if the outturn of Kansas, Louisiana and Arkansas is added the total of this small group rises above 90 percent. With the exception of California these States form a geographic and economic block and harmonious action among them should not be impossible of attainment.

It is through state action that most of the progress thus far made toward balancing production with demand in the United States has been accomplished. While a State cannot successfully maintain a policy that is not supported by public sentiment among its own citizens it can give force and effect to the will of the majority and can prevent constructive plans from being wrecked by the recalcitrance of a small minority. The crystallization of opinion in the various oil producing States has led to the enactment of legislation which gradually has been improved to stand the test of legal attack. As sentiment among members of the oil industry has become more favorable to proration of output, unit operation of pools and other measures of stabilization the regulatory machinery of the various States has been strengthened and made to function more efficiently.

For the most part the members of the commissions appointed to administer the oil legislation of the important producing States have dealt with their problems in a constructive way, have sought the opinion of experienced operators in working out the bases for proration and have obtained the services of qualified men to act as umpires. The methods employed have been such as to increase confidence in State regulation.

In contrast to the generally progressive course of the States in dealing with the problems created by an unbalanced relationship between supply and demand the policy of the Federal Government has been less clearly defined and at times has appeared halting and uncertain. In the early period of the present administra-

(Continued on page 645)

IN the absence of some modification of existing anti-trust laws of the United States, a change which he considers politically difficult of accomplishment, Mr. Mayo regards the establishment of harmonious action among the authorities of the principal oil producing States as being a practicable means of effecting a stabilization of the American petroleum industry. In the accompanying article he points out that most of the progress thus far made in this direction has been accomplished through conservation measures adopted by these States and directs attention to the growing tendency among state commissioners to confer together in the interest of a concert of action. World Petroleum is pleased to add this contribution to the discussion which has been going on in its pages in recent months.

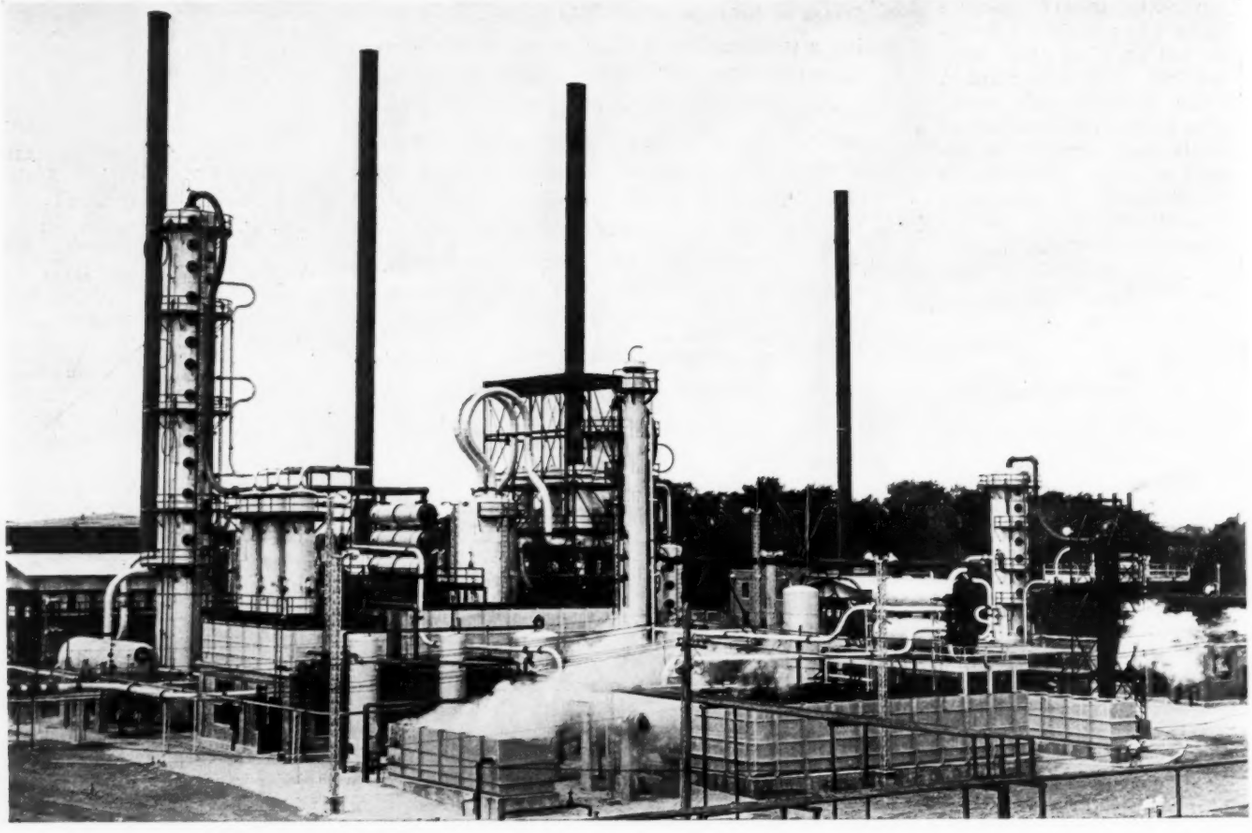
Novel Features In New Canadian Refinery

Tying Topping, Low and High Pressure Cracking and Stabilization Together In British-American Oil Company's New 8,000 bbl. Montreal East Plant.

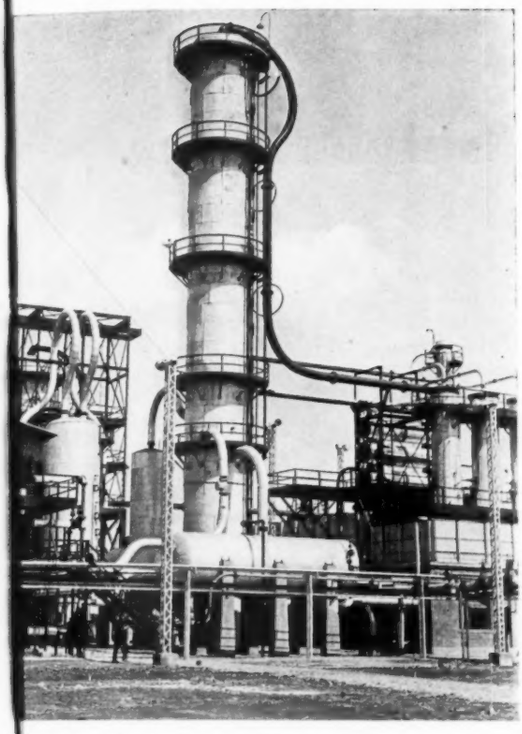
By R. C. Rowe

REFINERY design in recent years has made such rapid advances, that every new plant incorporates sufficient improvements and increased efficiency to warrant close study of their outstanding features. The new refinery of the British American Oil Company, Limited, situated in Montreal East, Canada, has two main features which render it worthy of more than ordinary comment. The first of these is the practical demonstration of a sound economic theory, and the other is a definite advance in the technology of refining, resulting in lower costs.

Turning first to the economic aspects of the project, we find the the new refinery is a concrete example of farsighted executive management, which operates on the theory that it is always wiser not to exhaust the potentialities of an organization. Management operating under this theory always has some potentiality that can be realized upon when conditions call for it: something that it can fall back on when an unusual situation develops. A refinery in Montreal was a potentiality that the British American Oil Company, Limited, has had in mind for some years. During the prosperous years, however, they did not realize on it, and it was only when the world passed into the present unprecedented period of depression that A. L. Ellsworth, president of the company, authorized the construction of the plant, thereby saving his organization many hundreds of thousands of dollars in freight, and giving it a strategic distributing point at a time when it is most needed. In the broader sense it has given work to makers of equipment, and provided employment for labor also at a time when these factors would do most good. Thus has the soundness of the theory that the liquidation of potentialities should not be carried to extremes in prosperous times been fully demonstrated, and it becomes evident that, had industry generally followed Mr. Ellsworth's policy and been in a



View of Refinery. Left to right, tube still with flash tower; heat exchangers and strippers; vapor-phase still; vapor separator and bubble tower, and high pressure still. At extreme right is re-run still and fractionating tower for cracked gasoline.



lash tower showing heat exchangers and strippers to e right. Vapor separator and bubble tower to left.

position to meet restrictive influences with deferred expansion and development programs, the economic pendulum would not have swung so far in the reverse direction as it has.

In a technical sense the new refinery is featured by the fact that topping, low-pressure, and high-pressure cracking, together with stabilization are all tied in together in one operation. There are several other minor features in the plant, referred to in the course of this article. The tying in of these four operations is new and is a definite advance in the science of refining. It will result in substantial cost reductions so its progress will be closely watched by the oil industry in general.

The refinery as a whole was designed by the technical staff of the British American Oil Company, Limited, under the direction of L. E. Wolley, manager of refineries. The details of distillation and the tying in of the topping, low-pressure cracking were worked out by Winkler-Koch Engineering Company of Wichita, Kansas. Details of the stabilization plants were furnished by Black, Sivalls and Bryson of Tulsa, Oklahoma. The principle underlying general design is reduction of costs and keeping capital expenditure as low as possible and the whole arrangement is laid out with this in view. Refinements in plant design save costs in labor and fuel, and general compactness in layout reduces maintenance charges to the minimum.

As stated before, the plant, which is a gasoline and fuel oil refinery, is situated in Montreal East, on the Canadian National Railway, three-quarters of a mile from the St. Lawrence River and was visited by members of the staff of WORLD PETROLEUM during construction and after completion. The company owns wharves and property at the river to which crude oil is delivered in tankers and pumped to storage tanks at the refinery. In this connection it might be pointed out that the port of Montreal is only open for seven months in the year, and when this fact is remembered the necessity of high-storage capacity becomes apparent. Crude storage capacity of the refinery is nearly 500,000 bbl., and an additional 500,000 bbl. finished product storage capacity is provided, a part of which can be utilized for crude storage if necessary. The Montreal refinery also acts as a terminal for the reshipping of crude by inland waterway tankers and railway to Toronto. As a mater of interest it might be noted that the initial crude oil supplies originated from East Texas.

The area covered by the plant and storage tanks is 90 acres, and the whole installation presents a remarkable building record in point of speed. In March of this year the company's engineers dug through deep snow to find the corner posts of the property. Not a sod was turned until April; yet, before the end of August, the plant was operating, the whole job having been completed in five months.

The present plant is the first unit of what will eventually be a very large refinery. It is designed to handle normally 8,000 bbl. of crude per day, with a top capacity of 10,000 bbl. It has a normal production of 227,500 Imperial gallons of gasoline per day.

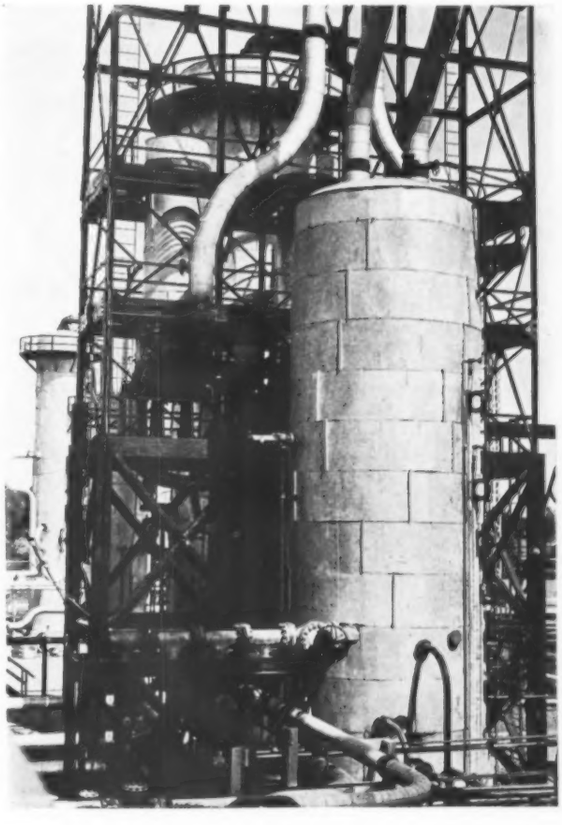
In the following brief descriptive outline it will be noted that the vapors from flash tower in the topping system, and the vapors from the vapor separator, and bubble tower in the cracking system are passed through heat exchangers, which are used for heating the various still charges.

Thus the crude is first passed through the topping vapor line heat exchangers before going to the water settler, after which it passes through the bubble tower vapor line heat exchangers, and eventually on to the tube still series, and thence to a flash tower where some five or six fractions are drawn off. The vapor line passes through heat exchangers as mentioned above, and from there to condensor and gasoline reflux drum. All products such as kerosene, naphtha, and gas oil for domestic purposes, are stripped before being passed to storage.

The residium from the flash tower, which contains most of the gas oil, is pumped to a tube still, and from there passes to a vapor separator, the bottoms of which is bunker crude, which is passed to storage under the international name of "Bunker C." The overhead stream of the vapor separator passes through heat exchangers on its way to the bubble tower, which operates in closed circuit with the vapor phase and high-pressure cracking stills. The vapor line of the bubble tower passes through heat exchangers to condenser, gas separating and stabilizing plant. The side stream from the bubble tower passes through heat exchangers to the vapor phase still, thence to the vapor separator and bubble tower. The bottoms of the bubble tower pass to the high-pressure still, and are carried back to vapor separator and bubble tower. As before mentioned the vapor line of the bubble tower is carried to the stabilization plant, and to a rerun still, being finally fractioned into cracked gasoline and fuel oil. All gases are treated in a gasoline recovery plant before being used for fuel purposes.

One of the features of the plant is its compactness which is such that control of operations is effected with the minimum number of men.

Vapor separator and bubble tower.



Petroleum's Influence Upon Shipbuilding

How Tankship Construction Problems Have Been Solved By Close Cooperation Between Oil Companies and Shipbuilders.

By H. Gerrish Smith
President,
National Council of American Shipbuilders

DEVELOPMENT of the petroleum industry, particularly in the United States, has had a very important bearing upon shipbuilding, not only in the construction of vessels for the transportation of oil, the burning of oil under ship's boilers, and in the advent of the Diesel engine; but also in the direct effect that these major developments have had upon the design and operation of vessels of all types. The rapid advance of the oil tanker in all of its phases is to a large extent an American development, although other countries have made substantial contributions, and the carriage of oil in bulk is probably the most efficient method of marine transportation now in use.

The world growth of the oil tanker industry has been quite remarkable. Whereas in the year 1900 there were only 182 oil tankers in service, each of 500 tons gross or over, aggregating about 425,000 tons gross, there are now over 1,500 in existence with a gross tonnage of over 7,750,000. In 1900 the United States had only eight tankers of about 11,000 gross tons. Today it has 514 American-built tankers of about 2,500,000 gross tons, or over 30 percent of the world total, and, as many foreign-built tankers are actually American-owned, the United States is by far the largest tanker owner in the world.

During the past three years 45 per cent of the world tonnage building has been oil tankers. Forty-eight percent of world tonnage building was propelled by Diesel engines and 36 percent of the steam propelled vessels were fitted with oil burning boilers. The tonnage depending upon coal only for operation was only 32 percent.

Owners and Builders Collaborate

THE successful carriage and use of oil in ships has taxed the highest ingenuity of naval architects, naval engineers and oil company engineers in solving the many difficult problems involved. Through the mutual efforts and the close cooperation that has existed between the oil and shipbuilding industry and others concerned, the problems have been successfully solved so that for many years the carriage of oil in bulk has been economically accomplished, and, through safety rules that have been established, the hazards involved have been greatly reduced if not eliminated.

The first vessels to carry oil in bulk were converted cargo carriers; but these were generally unsatisfactory, as the design of cargo vessels at that time was wholly unsuited to their use in the carriage of oil. Many of the problems involved in the design, construction and operation of bulk oil carriers, nevertheless, were learned in the operation of these converted vessels. It was early learned that a compartment or tank on a vessel that would hold water and be watertight might not hold oil without leakage, and that the design and workmanship necessary to secure oil-tight work were entirely different from the requirements for watertight work. A small leakage that might develop in a water tank would generally be absorbed due to rusting of the metal, but this would not occur with an oil leakage.

Stricter Construction Rules

TO provide for the carriage of mixed cargoes it is imperative that there should be no leakage from one tank to another and because of the inflammability of oil it is necessary that there should be no leakage into machinery spaces or into other compartments not devoted to the carriage of oil. Changes in structural design from those generally used on ships were necessary to assure oil tightness. Details had to be worked out so as to offer the minimum opportunity for leakage, and rivets had to be placed closer together than in vessels where water-tightness only was required. Classification societies hesitated to establish rules for the construction of oil tankers until sufficient experience had been obtained from vessels in operation to demonstrate that the designs and methods of construction were satisfactory. Tanker classification rules were first adopted by the Bureau Veritas, followed by the American Bureau of Shipping in 1902 and by Lloyds Register in 1909, although some rules formulated in 1894 by Benjamin Martell of Lloyds Register had been followed closely for some time.

Aside from the element of oil tightness there is another very important problem which affects the structural design of oil tankers. Oil is a fluid whose surface is free to move with the pitching and rolling of a ship. This free surface has an effect upon the ship's stability and if the free surface is too great it may not only dangerously increase the roll but in addition set up stresses and cause leakage due to the swashing of the oil. As a result the tanks in which oil is carried are made much smaller than those used for dry cargo, the usual length averaging about thirty feet as against a maximum of eighty feet for cargo vessels. Similarly, to control the movement athwartships, center line and sometimes other longitudinal bulkheads are fitted in tankers. In operation the tanks are filled to the maximum capacity allowable with proper consideration for the expansion taking place with changes in temperature. As this expansion is considerable, oil tanks have to be fitted with expansion trunks of small horizontal sectional area, so that under normal loading the only free surface of oil in a tank is that within the expansion trunk.

The necessity for small tanks, the closer spacing of rivets and the greater stiffness of bulkheads on oil tankers requires a heavier weight of steel than on a cargo vessel. For a vessel of about 10,000 tons deadweight this excess for a tanker may be as great as 600 tons.

Space Between Cargo Tanks

BECAUSE of the inflammable nature of oil cofferdams or empty spaces are fitted between oil tanks and machinery compartments, also between oil tanks and spaces that may be used for other purposes than the carriage of oil. Any

oil escaping into these compartments can be pumped back into the oil tanks.

Problems other than those involved in hull construction occur in the building of oil tankers such as the design of pumps for the loading and unloading of oil, and its transfer from one tank to another; the piping through which the oil is transported, the valves and joints in connection with which must be of a special design to assure their tightness. Special arrangements for the heating of the heavier oils in cold weather so that they can be more easily handled as well as appliances for cleaning out tanks after the discharge of oil are also necessary.

Speed Tendencies

HITHERTO oil tankers have been almost universally vessels of comparatively low speed. The cargo carried is such that as a general rule quick delivery is less important than economy of operation. They have been designed with a speed sufficient to make them readily manageable against sea and wind, but limited in general by considerations of economy to speeds ranging from ten to twelve knots. With recent changes in world movements of crude and refined products, and in competitive conditions, the tendency is towards higher speeds, especially with vessels of 10,000 tons and over. Some of the latest tankers are of 13 to 14½ knots speed. The permancy of this feature is open to question.

For convenience and safety of operation the machinery in oil tankers is generally placed aft, and the quarters for officers and crew either aft or in a raised deckhouse amidships.

Development of oil tanker construction has had its effect upon the structural design of vessels of other types. It was the oil tanker that brought about the construction of vessels with longitudinal framing now adopted to a considerable extent in vessels of ohter types. Many of the details and methods of construction developed in the building of tankers have been applicable to advantage in the building of all classes of vessels.

Oil Burning Ships

THE earliest oil tankers burned coal in the boilers, but the introduction of the bulk oil tanker was followed closely by the use of oil as fuel. This had very evident advantages. Oil burning like oil carriage involves special problems for the naval architect and the engineer. Fuel-oil tanks are constructed under the same rules for tightness as cargo-oil tanks; but the successful handling of oil from the fuel tanks to the boiler furnaces introduces other problems such as pumping, settling, heating and burning.

Removal of sediment from oil and possible small accumulations of water require settling tanks through which the oil can be passed, and where both sediment and water will settle to the bottom and can be drawn off. The viscosity of oil varies greatly with the temperature and with different grades of oil. To overcome these conditions it is necessary to provide oil heaters, controlling the viscosity and delivering oil to the burners in a sufficiently fluid state to permit of successful atomization.

Handling of oil from the fuel-oil tanks to settling tanks, then through oil heaters and to the burners at the furnaces of an oil-fired ship is by means of specially designed pumps which present ordinary engineering problems. The particular feature of oil burning, however, that has taxed the ingenuity of designers to the utmost is the oil burner itself. Experiments have been made with hundreds of types of which only a few have been successful. In fact, three or four types only are in general maritime use and they all utilize similar principles of design.

The problem involved is to atomize the oil as it enters the furnace and supply it with a sufficient quantity of air to permit of complete combustion. In the earlier designs of burners atomization was accomplished by means of steam. This was not wholly satisfactory. Later types of burners provide for mechanical atomization of the oil in its passage through the burner. Oil burning on shipboard has become so successful that at the present time about 60 percent of the United States and 33 percent of world steam tonnage burn oil, forming a vast seaboard market for oil companies.

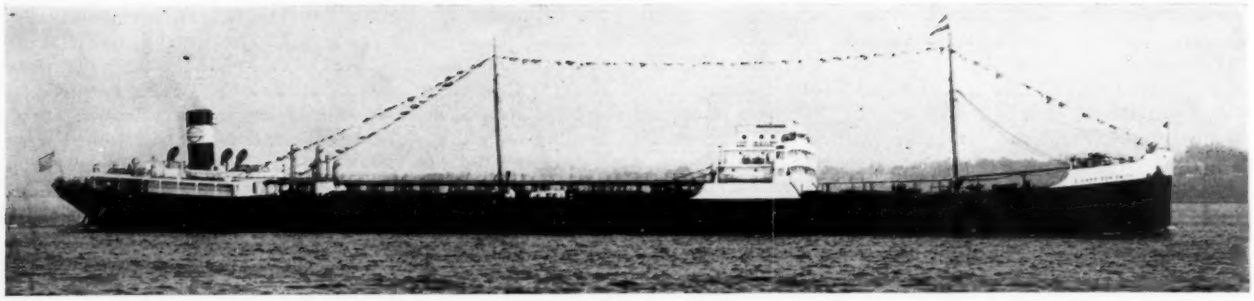
The Diesel Engine

USE of oil fuel in the boilers of ocean-going steam-driven vessels was followed about 1910 by the introduction of the heavy-oil internal combustion engine, known as the Diesel engine, the development and adaptation of which to marine work has brought forth entirely new studies and experiments in engineering both for the oil companies and the shipbuilders. The first sea-going Diesel tanker was the VULCANUS, a Dutch vessel still in service. The Russians, however, built a number of Diesel tankers for the Volga and Caspian between 1902 and 1908, including one river barge with electric transmission.

Notwithstanding the many different types of Diesel oil engines that are in use, their success has been such that at the present time over thirteen percent of world tonnage and over five percent of United States tonnage has engines of this type, while nearly one-half of world tonnage built in recent years has included Diesel engines.

What the future will bring forth in the carriage and burning of oil on shipboard can not be foretold, but it seems safe to predict that still greater efficiencies will be attained in oil burning installations, whether in connection with steam or Diesel machinery. The ultimate object, of course, is a low cost of operation and this is obtained not only through efficiency of propelling machinery but in all that enters into the cost of vessels upon which the carrying charges for depreciation, insurance and interest on invesement are based. While the cooperative efforts of shipbuilders and oil companies have accomplished much in this direction, a standardization of the requirements and types of equipment as between the different oil companies and a closer approach to standardized types of Diesel machinery would do much to lower the cost of oil tanker construction, with a consequent beneficial effect upon operating costs.

Most of the American Flag oil tankers built during the last few years have come from the Sun shipyard at Chester, Pa.



Ss. C. Harrison Smith, one of the most efficient oil tankers operating under the American flag. Built at the Federal shipyard for the Standard Shipping Company.

Jersey Standard's Vast Oil Carrying Fleet

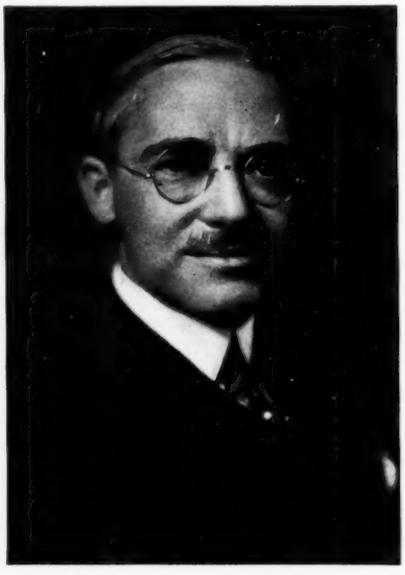
Planning, Building and Operating a World Tankship Service and Solving the Problems which Arise.

By Robert F. Hand

Vice-President and Ass't General Manager
Standard Shipping Company

IN any consideration of problems relating to the merchant marine, the position of the so-called industrial carriers invariably comes up for discussion. The fleets of the steel, fruit, sulphur companies and various oil companies, which they own primarily for the transportation of their own, or affiliated companies' products are referred to as "industrial carriers" in the United States. Included in the industrial fleets are 411 tankers of 3,998,984 deadweight tons, representing about 30 percent of the total deadweight tonnage of merchant vessels under the American flag.

The largest privately owned fleet under the American flag employed in ocean transportation is that of the Standard Shipping Company, marine subsidiary of the Standard Oil Company (New Jersey).



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Initial Construction

AT the time of the dissolution of the Standard Oil Company which became effective December 1, 1911, the Standard Oil Company (New Jersey) was left without any marine facilities, as previously all foreign shipping activities had been handled by the Foreign Shipping Department of the Standard Oil Company of New York. The Standard Oil Company (New Jersey) immediately organized a marine department and took over from the Standard Oil Company of New York the charters of four tankers. They soon realized the necessity of having facilities of their own and placed orders on December 31, 1912 and October 2, 1913 with the Newport News Shipbuilding and Drydock Company for the construction of two 12,000 deadweight ton tankers; these two vessels were named the JOHN D. ARCHBOLD and JOHN D. ROCKEFELLER, and were delivered in 1914. The former was lost during the War and the latter sold in November, 1924 and her name changed. From that time on up to the present date many tankers have been constructed for the company in American yards, including several of over 20,000 tons.

After the outbreak of the World War, enabling legislation having been passed authorizing the placing under the American flag of foreign-built tonnage, the Standard Oil Company (New Jersey) took over from foreign subsidiaries 27 tankers aggregating 210,000 deadweight tons.

The business of producing, transporting, refining and marketing petroleum and its products involves a number of other lines of activity which are highly specialized in themselves, and it is considered more efficient to place the control of these specialized, allied activities in the hands of subsidiary companies.

In line with this policy which the Standard Oil Company (New Jersey) has adopted, the Standard Shipping Company was formed and took over on September 1, 1927, all activities and marine equipment previously managed by the Marine Department of the company.

American-flag Ships

SHIPPING is decidedly a specialized industry and since the former Standard Oil Company (New Jersey) fleet represented one of the largest privately owned groups of merchant vessels under the American flag, it was logical in the interest of economy and the establishment of

the most efficient operating practice that the Standard Shipping Company should be organized as a separate unit.

In 1929, the Standard Shipping Company placed an order with the Federal Shipbuilding and Drydock Company of Kearny, N. J. for two large tankers which were placed in service during the last quarter of 1930. They are single-screw vessels of 25,750 displacement tons, 544 feet overall length, 75 feet molded breadth, 40 feet 6 inches molded depth and carry 20,615 tons on a draft of 30 feet 7½ inches under the provisions of the 1930 Loadline Act. These vessels are of the conventional tanker design, constructed on the Isherwood bracketless system, having one centerline bulkhead and being further subdivided into eleven main and five summer tanks with a cargo capacity of 154,000 bbl. The speed maintained in service is over 11 knots. The propelling machinery consists of a DeLaval turbine unit of the cross compound type, made up of one high-pressure turbine, in series, developing 4,400 s.hp. and connected through flexible couplings to double-reduction gears. The slow speed shaft is directly coupled to the line shafting. The astern turbine is arranged in the exhaust end of the low-pressure ahead turbine, and the low-pressure unit is designed to exhaust through the bottom of the casing into the condenser, set athwartships underneath. Steam is supplied at 400 lb. per square inch pressure, superheated to 750 deg. Fahr. and is furnished by two B. and W. watertube boilers having 5,080 square feet of heating surface and fitted with Todd oil burners.

The vessels are unique and unusual for their type, in having an all electrically operated engine room, and centrifugal cargo pumps operated by motors placed in the engine room, as well as electrical deck auxiliaries. The steering gears are of the hydro-electric type and the vessels are fitted with Oertz streamline rudders.

Everything has been done to make these ships modern and up-to-date in every respect, embodying all latest thoughts and ideas for efficiency as well as for the safety and comfort of the personnel. The vessels are equipped with complete radio apparatus of the latest type, with a radio direction finder, gyro compass and automatic steerer. Fathometer sounding apparatus is a part of their navigating equipment, the vessels also being outfitted with the recently developed Butterworth machines for tank cleaning.

Standard Shipping Fleet

AT the present time the fleet of the Standard Shipping Company consists of 45 ships, aggregating 612,964 deadweight tons.

The Standard Shipping Company acts as a clearing house and consultant on all matters connected with marine transportation for the Standard Oil Company (New Jersey) and its affiliated companies and in this category has designed and supervised the construction of all tonnage acquired by the foreign affiliated and subsidiary companies, during recent years.

The shipbuilding industry in the United States previous to the World War was dependent upon the construction of naval vessels and ships for the coastwise trade. The adoption of the principle of reduced armaments by the nations of the world has to a great extent eliminated the former class of work. The disposal of the large Shipping Board fleet constructed during and immediately after the War has restricted building for private account with the exception of vessels constructed under the mail pay provisions of the Shipping Acts of 1928.

The cost of constructing vessels in the United States with its higher wages and superior standards of living results in materially higher building costs, and without Government assistance it is quite impractical to build vessels in American yards for operation in the foreign trade in competition with vessels built abroad. Not alone is the first cost higher, resulting in heavier charges for interest, depreciation, and insurance, but operating expenses are also higher under the American flag. If ships are to be constructed in the shipyards of the United States for the foreign trade (other than vessels receiving mail pay) some way must be found to equalize the construction costs of American and foreign yards and lighten the burden of heavy operating charges under the American flag.

The higher operating expenses of American tankers, coupled with the natural desire on the part of the principal Governments of European countries in which the Standard Oil Company (New Jersey) has marketing organizations, to have a large portion of their petroleum requirements carried in ships of their respective flag, has made it necessary for the affiliated companies in those countries to acquire tonnage under various European flags.

Foreign tanker tonnage owned and operated by the affiliated and subsidiary companies of the Standard Oil Company (New Jersey) aggregates 101 tankers of 918,739 tons d.w.c. of which 47 ships of approximately 557,751 tons d.w.c., or 60 percent, are motorships. The oceangoing tonnage of the Standard Oil Company (New Jersey) group of all flags consists of 146 vessels totaling 1,531,703 tons d.w.c.

Gasoline Under Pressure

WHEN the volume of casinghead, or natural gasoline required by the refineries for mixing with low gravity gasoline, increased to an extent that large enough quantities were available for transportation by tanker, the Standard Shipping Company made a thorough investigation to determine the practicability of transporting this product with safety and with the minimum loss of cargo in transit. As a result of this investigation, two vessels, the W. J. HANNA and S. B. HUNT were specially equipped for the carriage of this product. The two principal features in the system used on these vessels consist of a gas-salvaging and a water-cooling system which may be applied to one or any number of the vessel's tanks, in which the hightest gasoline cargo is carried under pressure. Experience has shown that mixtures of casinghead and gasoline and even the more stabilized grades of casinghead may be carried in these specially equipped tankers with exceedingly small transportation losses and with entire safety.

In addition to its great fleet of tankers the Standard Shipping Company operates a fleet of tugboats, self-propelled and towing barges for the delivery of gasoline, refined oil, fuel oil and gas oil to marketing stations on the Chesapeake Bay, Albemarle and Pamlico Sounds and their tributaries. Flat bottom barges which carry clean products from the refinery at Parkersburg are operated on the Ohio River.

Safety Precautions

AS loyalty and efficiency of the seagoing personnel are important factors in the efficient operation of any vessel, it has always been the policy of the Standard Shipping Company, which incidentally was the first American company to adopt the eight-hour day for its seagoing personnel, to make conditions of employment attractive to its seagoing personnel and to encourage them to continue in its service. In line with this policy, sickness and insurance benefits are provided and participation may also be made in the Stock Acquisition Plan of the Standard Oil Company (New Jersey).

Years ago Abraham Lincoln summed up the responsibility that every human being owes to his fellow worker as follows:

"It is the duty of every man to pro-

tect himself and those associated with him from accidents which may result in injury or death."

To the end that the suffering and cost incidental to personnel accidents on board ship may be kept at a minimum, the Standard Shipping Company has inaugurated an extensive safety program. On each vessel of the company's fleet, a Safety Committee, with the master as chairman, holds regular meetings at which suggestions are made for reducing and eliminating accidents: first-hand investigations are also made of accidents which have occurred on the vessel and the necessary action taken to prevent their recurrence. These Ships' Safety Committees report to a Port Safety Committee at New York which investigates all accidents, regulates the company's safety activities and acts as a clearing house for the dissemination of safety suggestions and the establishment of a common safety practice throughout the fleet.

Due largely to the activities of their safety committees, some of the vessels have gone over two years without a single lost-time accident, a record of which any vessel may be justly proud and suitable Safety Certificates have been presented to these tankers as a mark of the Standard Shipping Company's appreciation.

Question of Wages

THE wage scales paid on American vessels being materially higher than those on foreign ships constitute a serious handicap which confronts the American tankship operator in meeting foreign competition. In this connection, it cannot be too clearly pointed out how vital a part ability and experience of Master and crew plays in the cost and character of operation. The vessels spend about 80 percent of their time at sea, during which the care and upkeep of the property, safety of the vessel and expenditure of stores and provisions are entirely in the crew's hands. This necessitates a careful selection of officers as well as crew, and makes an efficient shore organization essential, in order to eliminate costly delays.

Stores and provisions form another substantial item of operating costs, economies in which are effected by quantity purchase and the maintenance of storehouses at the principal ports of call; the company's principal storehouse is at Bayonne, N. J. In order to reduce the number of items to be requisitioned and insure the ship receiving the article required promptly, standard store lists, with each item numbered, have been prepared to serve as a basis for all requisitions, and the storehouse stock is correspondingly maintained, which procedure obviates confusion and reduces the cost of supplies by standardization of requirements. Economy in cost of provisions can only be secured by their proper use, and for that purpose a cooking school is maintained where stewards and cooks are trained in the preparation and service of food, as well as in other details of their duties. Every effort is made to furnish the seagoing personnel with only first-grade food, cooked in an appetizing manner.

Care of Personnel

SEAMAN'S missions throughout the world have always done their bit by distributing magazines and a few books, but they have never made any pretense of having a real library service, so the American Merchant Marine Library Association was founded in 1921, with the sole object of supplying seamen with good reading matter, and had over 48,000 books in circulation during its first year. This organization has grown and expanded since that time until it boasts more than 340,000 volumes in circulation today. The far-reaching activities of the Association through its book drives have done much to interest the American people throughout the country in the upbuilding of the merchant marine. Books are obtained largely by these drives as gifts from the public, but to procure the vast number needed each year is no small task. The libraries are delivered or exchanged through any one of the offices or agencies of the Association and therefore may or may not reappear at the office from which they started.

Each month the Standard Shipping Company publishes for the seagoing personnel a Bulletin of approximately 28 mimeographed pages. This publication serves as a link of interest and cooperation between the Management, Office and seagoing personnel, and contains much of interest to the men afloat. The Bulletin contains a general manager's page; articles on safety work; items of routine interest; general orders to the vessels' deck and engine departments; ship and port news including hydrographic and radio information; a series of educational articles of marine interest, also marine and personal notes. Every effort is made to make it a reliable marine publication of particular interest and educational value to the men who go to sea in the company's ships. Numerous requests for copies of the Bulletin are received from outside sources; however, since the publication is mimeographed and is intended primarily as a house organ, it is the company's policy to restrict the circulation to employees and those immediately concerned with the company's business.

Operating Costs

IT will perhaps be of interest to consider some of the problems involved and the constant efforts made to keep down operating costs. The fixed charges of interest, depreciation and insurance are naturally affected by the first cost of the vessel. The practice has been to fix the rate of depreciation on the basis of 20 years life of the ship, this basis of depreciation being a legacy from past experience with ordinary cargo vessels. During recent years, however, abundance of evidence has been produced showing that tankers must be written off in less than twenty years, if adequate provision is to be made for the ravages of corrosion upon the hull structure, a feature which is not of commensurate importance in ordinary cargo vessels.

Insurance should conservatively be based upon the replacement value of the hull and machinery and as it is the Standard Shipping Company's practice to carry its own insurance, extraordinary diligence is exercised to eliminate accidents to its fleet and particularly rigid rules are enforced. As a concomitant procedure, all vessel accidents are carefully investigated and prompt action taken to prevent a recurrence, which practice has resulted in greatly reduced expenditures for vessel accidents and fully justifies the time and expense devoted to the investigations.

In view of the magnitude of the fixed charges it is, of course, necessary for the owner to obtain a ship at the lowest cost consistent with good workmanship and material. Good workmanship is particularly essential in the hull construction of oil tankers, if leakages are to be avoided and costly repairs eliminated during the operating life of the vessel.

Question of Ship Speed

WITH the adoption of the Diesel engine for the propulsion of tankers, there has been a tendency toward higher speeds, this condition being brought about by lower fuel cost for an increase of speed and also extra carrying capacity in the case of motor tankers, as compared with steam tankers. The

tanker with respect to speed is in a somewhat different category from the ordinary cargo vessel in general trade, inasmuch as high speed general cargo vessels may in normal times command a relatively higher freight rate for the carriage of the more valuable or perishable general cargoes, leaving the general bulk commodities to be transported at a lower freight rate by slower vessels. In the case of a tanker, voyage freight rates are little influenced by the speed of the vessel, or for that matter to any great extent by the different nature of petroleum products carried in bulk, although there is usually a somewhat higher freight rate in the case of high-test gasoline and lubricating oil cargoes which require specially constructed vessels and equipment. The corrosion in cargo tanks arising from the carriage of clean products necessitates costly structural repairs which in turn must be reflected in the cost of transportation of these products.

In normal times, when freight rates are good the higher speed motor tankers can make extra voyages per year in proportion to their excess speed over that of the normal steam tanker. When freight rates are low the excess speed is an incumbrance in the sense that the higher powered machinery represents an increased capital outlay, which is reflected by the higher fixed charges when compared with slower speed vessels.

In the case of two 15½ knot tankers recently put into service under the American flag the fortunate circumstance of being able to procure higher powered economical steam turbine machinery at a favorable price compared with lower-powered less economical reciprocating engines, doubtless influenced the owners to construct these two high speed tankers.

Two Speed Phases

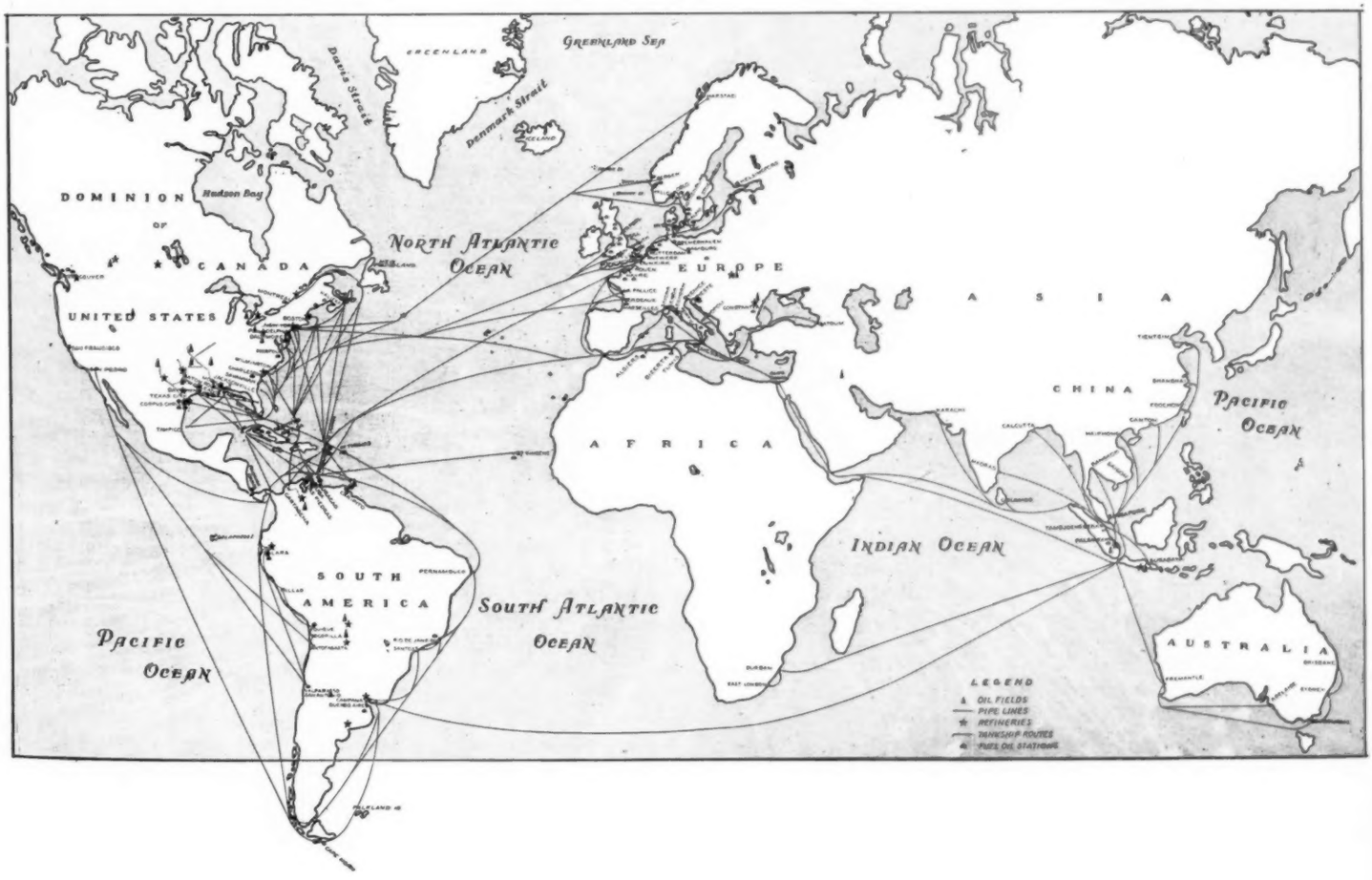
THERE are two phases of the speed problem, one being to attain the minimum cost of transportation per barrel of cargo, the other being the maximum revenue which the tanker can earn during a prescribed period, this maximum revenue involving another variable, that is the profit differential which does not enter into the question of speed when considering the net cost of transportation per barrel.

With a higher speed it is possible to make more voyages in a prescribed period when freight rates are higher than the net cost of transportation. In the case of higher speeds the first cost of the vessel is higher, and its deadweight capacity less, due to finer body lines; the fuel cost per day is also higher. Due to the reduced time for a given passage at higher speeds there is a reduction in the total charges for insurance, interest, depreciation, overhead, wages, provisions, stores, etc., although the per diem rate for some of these items may be higher than in the case of a slower speed vessel.

The problem, therefore, is to balance the items of cost against the increased revenue in a given period at higher speeds; if there is not a profit differential between the net cost of transportation and the freight rate, then there is no reason for higher speeds, indicating that speed increase varies directly with the differential of profit between the net transportation cost and the freight rate; that is the difference between cost of the service and the value of such services in the open market.

Varying Fuel Costs

FUEL represents an important item of operating expense and is a commodity subject to some fluctuations in



World tanker routes of the Jersey Standard group.

price, characterized by a price of $1.05 per barrel for grade "C" bunker at New York in the beginning of 1931 as compared with the current price of 60c per barrel. Corresponding cost of Standard Diesel fuel was $1.85 per barrel at the beginning of the current year as compared with the prevailing price of $1.30 per barrel at New York. Naturally these fluctuating prices have an important bearing upon the kind of fuel used; for instance in the case of a 16,000 ton reciprocating engine propelled steam tanker in the Gulf-New York trade, fuel represented approximately 18 percent of the operating cost at the beginning of this year, but at present prices only about 10 percent, while in the case of a similar sized Diesel vessel, fuel cost at the beginning of the year was 14 percent of the operating cost as compared with 11 percent at the present time. The relative importance of the various items which constitute operating cost are normally as follows in the case of a steam vessel: depreciation, fuel, wages, repairs, insurance, overhead and stores. Naturally there may be changes in order of importance of these items for different types of vessels and the circumstances of the trade.

Reducing Port Time

ONE of the principal factors in keeping down operating costs is to reduce to a minimum the time spent in port by tank vessels, because it is really in performing their function of transporting cargoes at sea that they are earning revenue, whereas during unnecessary delays in port, fixed charges and running expenses are mounting up, upon which no return will be realized. As stated elsewhere in this article, shore pipelines and facilities should be in immediate readiness for the acceptance of cargo, so that hose may be connected the instant a vessel touches the dock and the maximum pumping rate maintained during discharge.

The Company's high standard of efficiency in the loading and discharging of oil cargoes is exemplified by the following performances in 1931: The S.S. JOHN D. ARCHBOLD discharged 147,337 bbl. of Colombian crude at New York in 13.83 hours or an average rate of 10,653 bbl. per hour. The MS E. T. BEDFORD loaded 116,870 bbl. of West Texas Crude at Harbor Island, Texas in 4.42 hours at an average rate of 26,441 bbl. per hour.

These high loading and discharging rates require the utmost vigilance by both vessel and shore personnel, so as to avoid overflows and accidents, and naturally necessitate the pumping and cargo equipment being in good condition.

Arrangements for entering and clearing the vessel, towage, paying off and signing on crews, storing the ship and meeting other needs must be so timed that the ship can sail immediately upon completion of loading or discharging.

Many items of port charges, including pilotage, tonnage dues, etc., being established by law, are beyond the control of the operator, but all controllable items of expense are closely scrutinized to prevent these from reaching unreasonable levels.

Government Regulation

MARITIME jurisdiction being vested in Federal Government departments, shipping is subjected to regulations substantially affecting operating costs which can in no wise be controlled by the owner. In fact, the laws fix the number of men to constitute the crew of a vessel as well as nationality and qualifications of the men; also the conditions under which wage payments shall be made, including cash advances at ports of call; harbor regulations necessitate employment of pilots; there are statutory provisions concerning the construction of machinery and boilers, involving inspection while building and annually thereafter to assure compliance with established standards; regulations regarding wireless as well as installation and maintenance of lifesaving equipment; and in many other ways the operating costs of shipping are increased through Government regulations, which, while often beneficial, add greater burdens and expenditures than in the conduct of other private business enterprises.

Shore Supervision

COORDINATION necessary to bring about desired results demands constant supervision and though perhaps impossible to prove, it is undoubtedly a fact that economies effected through the expenditure of thousands of dollars for competent shore supervision, result in savings of hundreds of thousands of dollars in the costs of repairs, stores and provisions, fuel, port charges and time saved in port.

Corrosion of the interior structures of tankers, particularly those carrying refined products, has in recent years become one of the tanker operator's greatest problems and part of the shore supervision work is to solve it. It is, of course, quite impracticable to estimate the loss involved as this depends largely on the kind of cargo carried, as well as the quantity and location of ballast water, but much effort and money have been expended in an endeavor to find a protective coating which would eliminate, or at least retard this corrosion.

Experience proves that corrosion is much less evident in vessels which have been employed in dirty service, i.e., carrying crudes, fuel oil, gas oil, etc. All finished products such as gasoline, refined oil, etc., must pass a corrosion test which practically precludes the possibility of these products containing any element or chemical in amounts which would directly cause excessive corrosion, but it is believed that the cleaning action of gasoline and other refined oils on the metal surfaces in the tanks in which they are carried, exposes the metal to the action of salt water ballast subsequently carried. The corrosion of the interior structure of tankers is more evident in the upper or vapor spaces of the tanks, although in most cases the bottom plating and structural members are also affected, particularly in vessels where drainage has been somewhat unsatisfactory. Some authorities recommend the removal of loose and absorptive rust scale so as to reduce the rate of corrosion behind damp scale adhering to the structure, but opinions differ widely as to the relative efficacy of this procedure.

Hull Stresses

CONDITIONS of service under which tankers operate are undoubtedly much more severe than with any other steel structure ashore or afloat, and the hull material and rivets are highly stressed due to the natural movement of the vessel in a seaway as well as to the surging of the oil cargoes.

It is well known, of course, that stressed and fatigued material is more liable to corrosion than material in good condition and obviously the practically continuous reversal of stresses in the hull material while at sea, expedites fatigue of the metal, which probably accounts for the increase in rate of scale formation as vessels increase in age; fatigue of metal and formation of rust is also, we believe, expedited by the practice of "steaming and washing down" tanks, for cleaning and gas-freeing purposes. Practically the entire bottom riveting in some tankers has had to be renewed after only a few years of operation on account of the rapid corrosion set up after the paint has been scrubbed off the rivets in shoal water channels. Puddled iron rivets are now being used to reduce such corrosion.

The subject of tanker corrosion is still in the investigation stage and its solu-

tion may involve some changes in design of the interior structure of tankers, the methods of handling cargoes and the cleaning of tanks. In any case it is important that the corrosion in clean tankers be arrested and the life of the vessel prolonged so as to reduce the expensive structural repairs and depreciation charges.

Cargo Tank Cleaning

In order to eliminate the steaming of tanks with its obvious disadvantages of straining and corrosion, the Standard Shipping Company has adopted on all its vessels the Butterworth system of tankcleaning to eliminate steaming and at the same time greatly reduce the cost of cleaning operations. With this system the tanks are washed by heated water directed against the sides of the interior of the tanks in a solid stream at high pressure from revolving nozzles. These nozzles turn slowly in horizontal and perpendicular planes, so that their position changes continually with each revolution, causing the stream to be eventually directed against all interior surfaces of the tank. The nozzles are part of a machine that is lowered down through an opening in top of the tank, reaching down to about one-half the depth of the tank.

During the cleaning operations the tanks are well stripped, keeping the bottoms free of water, thus realizing the full force of the streams on the tank bottoms, which results in the breaking up of rust scale so that it is pumped out with the water. When cleaning from black to refined oil, it is sometimes necessary to wash with kerosene or furnace oil. For this only a comparatively small quantity of cleaning oil is required, and it is circulated through these special cleaning machines at high pressure in the same way as the water. This system of tankcleaning by machine has, as stated above, proved entirely satisfactory, and has resulted in a great saving in time, as well as reducing the cost of cleaning tanks.

Terminal Equipment

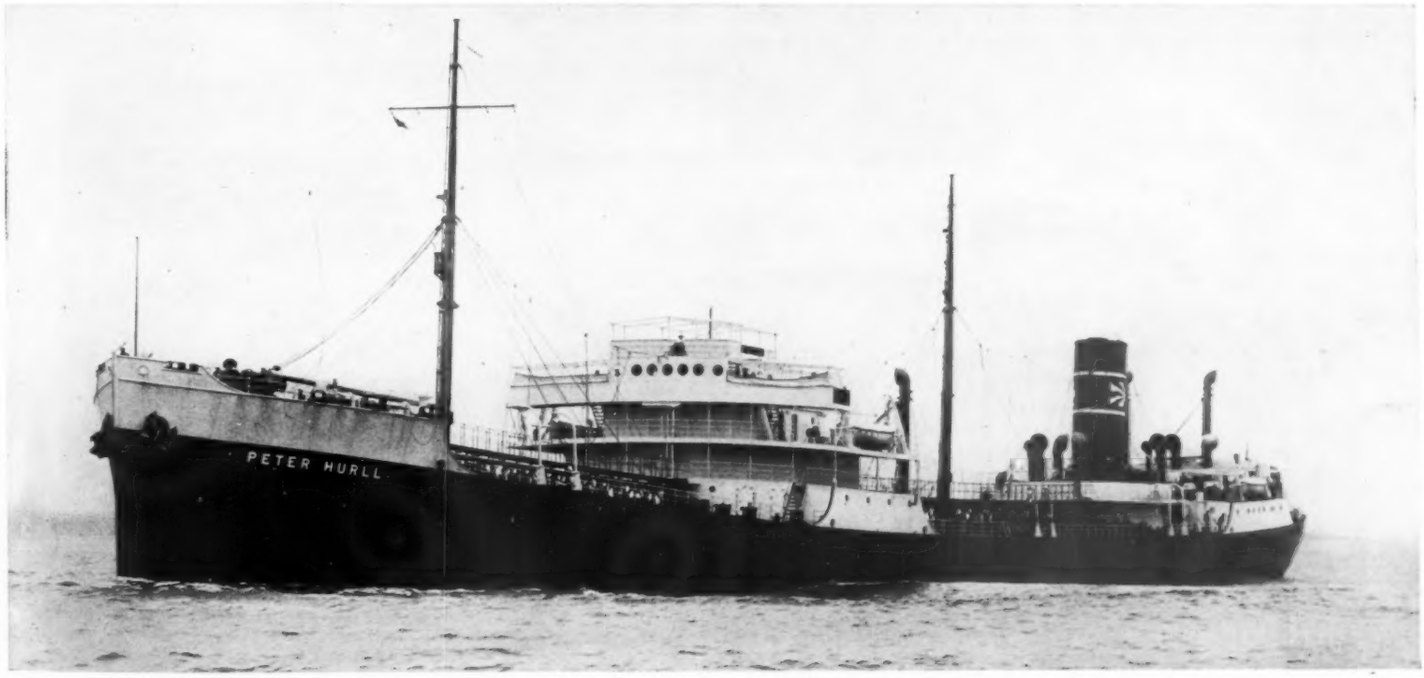
Modern oil loading terminals facilitate the economical marine transportation of oil, and it is the modern equipment of these terminals, together with adequate pumping equipment on board the tankers which makes possible the quick turnaround of a modern tanker in port. The past quarter of a century has seen the growth of loading and unloading terminals in the United States, advance from a very insignificant beginning to the terminals of present-day standards, many of which rank among the largest and most efficient in the world.

Subsidiaries and affiliated companies of the Standard Oil Company (New Jersey) maintain modern oil terminals at convenient locations in the Gulf of Mexico and along the Atlantic seaboard. At these terminals, all parties concerned cooperate to the fullest extent so that cargoes are loaded and discharged with the utmost dispatch.

The large terminal at Baton Rouge, La. is the property of the Standard Oil Company of Louisiana and is located about 245 statute miles from the Gulf of Mexico, the river having a navigable depth of 35 feet at low stage. From this terminal, petroleum products are shipped by tankers to eastern and foreign markets, and by barges up the Mississippi River for interior distribution.

Approximately eight miles from Bolivar Roads and located at Texas City on Galveston Bay is the terminal of the Humble Oil and Refining Company from which chiefly crude, though also some refined products, are handled. Approximately 28 miles from Bolivar Roads on the Houston Ship Channel is Baytown, the main refining and loading terminal of the Humble Oil and Refining Company, which handles both crude and miscellaneous refined products.

On Harbor Island about two miles from the Bar at Aransas Pass, Texas, is located the crude terminal of the Humble Pipe Line Company, which has the largest hourly rate of loading of any terminal in the Gulf coast area.



High-speed motor tanker Peter Hurll of the Jersey Standard group. She is of 17,585 summer d.w.c. and 6200 i.hp.

This terminal, which has berthing space for two ships, holds the record for an average loading rate of over 26,000 bbl. per hour. Approximately nine miles up Corpus Christi Channel, near Ingleside, Texas, is the original terminal of the Humble Oil and Refining Company which is now used principally for refined products. As previously stated, the Company's terminals at Constable Hook and Bayonne, N. J. and Baltimore, Md. are of the most modern construction and equipped with a very complete system of pipelines for receiving crude oil cargoes with the utmost dispatch. These terminals are also equipped as loading terminals for refined white products, lubricating oils and asphalt. Naturally, the layouts at oil terminals, and type of equipment used, vary at the different ports.

For fire protection, some of the larger docks, especially those adjacent to refineries where steam in large quantities is available, are equipped with steam lines on the dock, as well as water, foamite and/or CO_2. Where steam is not available in sufficient quantities, some standard foam or CO_2 system is installed for the entire protection of docks, station buildings, tankage and tankers using the terminal.

The dredged channels leading to some of the oil terminals constantly silt up and dredging is necessary in order to maintain an adequate depth of water to permit vessels loading to their designed draft, and at the same time eliminate grounding accidents and minimize the rivet erosion incident to dragging bottom in these restricted waters. The United States Corps of Engineers who are charged with the development and maintenance of channels in American harbors and rivers render a great service to the steamship owners in general and tankship operators in particular by keeping the dredged channels clear.

Load Line Rule

ON September 1, 1930, the U. S. Load Line Act, passed on March 2, 1929, became effective for vessels engaged in the foreign trade (the Great Lakes excepted); prior to that time there was no law in the United States limiting the draft to which vessels might be loaded and it was the generally accepted practice of American tank steamer owners to load their vessels deeper than tankers under foreign flags, as the load lines of the latter vessels were fixed by law. The matter of load line legislation in the United States has been the subject of investigation for many years; the idea of preferential load lines for tank steamers first came to the fore and was recognized in principle by the U. S. Load Line Committee, 1919-21.

American tank steamer interests, through a Committee of the American Steamship Owners' Association, brought this subject before the International Shipping Conference held in London in May, 1925, and at that meeting it was decided to appoint technical sub-committees in each country to consider the subject. The American Technical Sub-Committee made a very comprehensive investigation and analyzed the loadings of tankers for no fewer than 17,000 voyages; elaborate charts with supporting data were prepared and presented to the International Shipping Conference held in April, 1926, recommending a reduction in freeboard of tankers of about 20 percent in the case of tankers of the poop, bridge and forecastle type, above 425 feet in length. In the case of flush deck vessels this maximum reduction was proposed to be allowed only where the freeboards at stem and stern post were not less than specified in the report. No reduction in freeboard was advocated for any tanker under 250 feet in length, and the maximum reduction was only to be allowed in the case of tankers where the structural strength was up to the most modern requirements.

Tanker owners of other countries attending the April 1926 Shipping Conference were not prepared to accept a 20 percent reduction and a compromise was therefore reached recommending a reduction of about 15 percent in the average size tanker.

In 1928, the Secretary of the U. S. Department of Commerce appointed the U. S. Load Line Committee to advise upon the subject of load lines for United States merchant vessels and to recommend legislation relative thereto. The recommendations of this committee were used as the basis in presenting the American point of view at the International Conference on Load Lines convened in London on May 20, 1930, which resulted in a Convention being signed on July 5, 1930 by the representatives of 29 countries. This Convention if ratified, will come in force on July 1, 1932.

The outstanding point of this Convention is the emphasis that is laid on protection of all deck openings and the safety of the crew, and of special load lines for timber ships and tankers. The extreme importance of protecting all weather deck openings in the ship against the sea in bad weather has been fully recognized, and the rules on this subject are more definite and more emphatic than they have ever been before.

In order to secure deeper loading of tankers, as provided in the regulations of the Convention, certain conditions of assignment which relate to the construction of the ship, machinery openings, fore and aft gangways, ventilators and facilities for freeing the deck of water, must be observed. In respect to existing tankers, compliance with these requirements is optional but owners desiring to secure the deeper load lines for their tankers must make the necessary alterations in their tankers to comply with the regulations of the convention.

Regulations Become Effective

THE regulations which have been issued by the Bureau of Navigation of the U. S. Department of Commerce under the U. S. Load Line Act which became effective on September 1, 1930 for vessels in the foreign trade are practically identical with the regulations of the International Convention, and American tankers are now permitted by law to load deeper. Official recognition has thus been given to the claim of American tank steamer owners that vessels of this type can be loaded deeper than ordinary cargo vessels with due regard to the safety of the crew, vessel and cargo. Several of the European countries have also adopted regulations which permit their tanker owners to take advantage of the deeper loading provided by the International Convention.

The United States was the first country to ratify the London Convention, which action has also been taken by several of the European countries, and it is confidently expected that this Convention will become effective on July 1, 1932.

At the Conference it was also agreed that the United States of America may initiate a conference of the contracting Governments of the countries to which tankers belong for the purpose of discussing tanker freeboard at any time within five years. The Conference also recommended that the Governments of the countries to which tankers belong shall keep records of all structural and deck damage to these ships caused by stress of weather, so that information with regard to these matters may be available for future consideration.

The Loadline Regulations of 1930 actually reduced the carrying capacity of American tankers and increased that of foreign tankers. It must be appreciated that this sacrifice of deadweight has imposed a considerable hardship upon American tankship owners who had

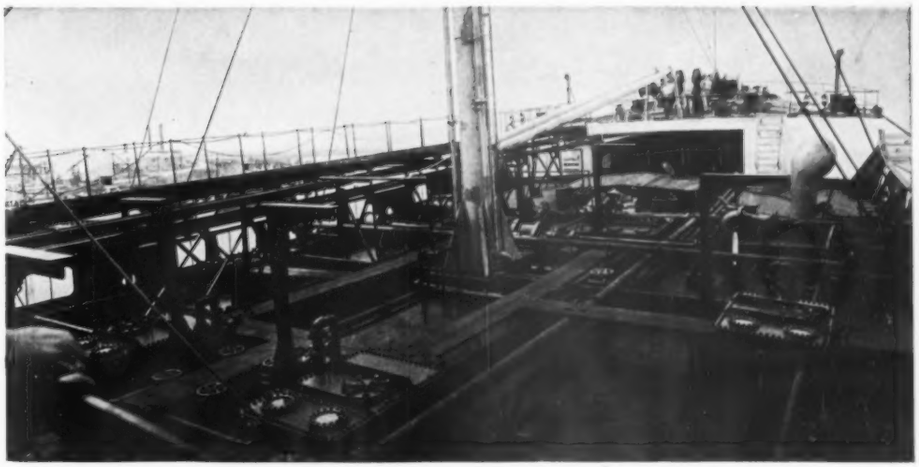
been operating their vessels safely and satisfactorily at deeper drafts, and in addition has subjected them to considerable expense in order to comply with the conditions laid down in respect to steel hatches, tonnage openings, fittings, weather doors, freezing ports, forecastle, etc., and they are also penalized in the case of some vessels which have flat sheer, but which had previously behaved satisfactorily in heavy seas.

The reduction in the deadweight capacity due to increased freeboards under the 1930 Loadline Convention indicates that the entire American tanker fleet suffers a reduction in deadweight of upwards of 150,000 tons if these vessels were employed entirely in foreign trade, whereas tanker tonnage under foreign flags upon ratification of the convention will enjoy an increase in deadweight of upwards of 450,000 tons, including new construction now approaching completion. American owners initiated the idea of a special loadline for tankers because of their years of experience in the operation of deeper laden tankers and also owing to the physical characteristics of these vessels. They fully realized that if a loadline law was enacted, their ships as a whole would suffer a reduction in deadweight capacity, but believed the sacrifice would be justified by the benefits which would come from uniformity in loading practices and in the advancement of International comity.

World Competition

THERE are perhaps few enterprises which have so strong an appeal to romance and imagination, so colorful in contact with other lands and which by reason of being the field in which all nations of the world compete, offer the risk and fascination attending any game with great odds as does the operation of ships. The variety of problems which beset ship operation are so complex and bewildering that their most satisfactory solution requires the shipowner and operator to be better informed regarding national and international business affairs and conditions that most other types of business men.

In the conduct of his business the tankship operator is concerned in varying degree with the production problems of the oil industry, oil tariffs, export and import monopolies, labor and shipbuilding costs, financial and political crises, trade depressions, subsidies to fleets and to shipbuilding, anti-trust laws and all the other numerous laws, local and international, wihch are associated with shipping.



Water cooling system for the decks of the high-test tankship W. J. Hanna.

All these matters have a direct bearing upon ocean transportation of oil and their undesirable cumulative effect is evidenced at this time in the synchronizing of the excess oil tanker tonnage with the world-trade depression and the production troubles of the oil industry. As in any other business success in the last analysis depends upon competent judgment, supervision and management in coordinating the various activities, anticipating the future and being quick to sense and meet constantly changing conditions.

The dawn of the oil era inaugurated a group of new and complex conditions in the realm of transportation at sea. Oil quickly thrust itself forward, through and beyond the front rank of other world commodities. The development and adoption of the automobile in its present form has resulted in the consumption of enormous quantities of gasoline and motor lubricating oils. In addition, there has been an enormous increase in the use of petroleum products for boiler and internal combustion engine operation ashore and for the propulsion of oceangoing vessels. In 1914 less than 12 percent of the world's total gross tonnage of merchant vessels used petroleum products for fuel as compared with no less than 44 percent in 1931, based upon the latest Lloyd's Register returns. The consumption of petroleum products for aviation purposes is also growing with the increasing use of airplanes.

Transportation Systems

SINCE petroleum is a world commodity, the principal agencies for its transportation in bulk are the pipeline, tanker, tankcar and tank truck, each highly specialized and developed within the industry which have united the world's oil fields into a more or less common resevoir. The original sources of crude oil, as well as the markets, are scattered practically all over the world, and since the major part of production is a long distance from some of the markets, refineries are built either near the production or the markets, depending to a great extent upon the relative refining costs and permanency of the crude supply.

The chief function of tankers as an agency of transportation is to keep the refineries supplied with crude oil and the distributing terminals with finished products. By reason of great flexibility, transportation by tanker makes it possible to draw upon sources of supply and create markets otherwise inaccessible. This flexibility is of particular advantage in the conduct of operations subject to the vicissitudes which prevail in the petroleum industry.

To insure even deliveries to the refineries and consumers, thus minimizing the fluctuations in labor requirements, maintaining storage tankage at a minimum, and avoiding delay of tankers or tank cars or the shutting down of pipelines, it is essential that the agencies of transportation be efficiently coordinated.

Tanker transportation is essentially one-way traffic. As a general rule whether the tanker is moving crude to the refineries or finished products to the markets, it must return in ballast to next loading port. Efficient allocation, however, reduces the ballast voyages to a minimum, and, occasionally the cost of a normal ballast run may be reduced by returning with cargo such as creosote, whale oil, palm kernel oil or various other bulk products. As a general rule, however, the oil companies owning tanker tonnage do not avail themselves of all opportunities to secure such cargoes because of the difficulties involved and the cost of cleaning the tanks, etc., as well as the disadvantage of committing tonnage to proceed to a specific port and thus desroy the flexibility of their fleet.

Allocating Boats

IN order that tankers may be allocated to the best interest, it is necessary

to select a vessel from the fleet as close as possible to the size and position required, and which-on account of the last cargo carried is in condition for the particular grade of oil to be loaded. The size of the vessel must also be convenient for navigation of the channels which give access to the oil terminals concerned with the loading and discharging of a particular cargo.

In figuring the position of the vessel, i.e., the date on which it is expected to be ready to load the particular cargo, consideration must be given such matters as delays for repairs, seasonal weather conditions, congestion at the various ports of call and the preparation of the vessel's tanks to meet the requirements of a particular cargo.

The choice of a vessel is also influenced by the nature and length of the voyage because a tanker propelled by Diesel engines is probably the most economical on a long voyage. If a vessel has been employed for an extended period in the gasoline trade the corrosion state of her tanks may render it advisable to switch her into the dirty trade. Another consideration in the selection of a vessel is the relation of her cubic capacity to her deadweight for obviously a vessel with large cubic capacity should be selected if the cargo is to consist of gasoline. The cargo pumps and arrangement of pipelines must also be suitable for the grades of cargo to be handled.

Tanker Rates

WHILE fundamentally, of course, ocean rates are governed by the natural laws of supply and demand, violent fluctuations and world-wide competition have forced them to a basis of what the traffic will bear, rather than cost plus a reasonable profit. This operates so that in periods of depression transportation is often performed at much less than the cost of the service, whereas, in periods of heavy movement high rates obtain. The owner depends on the average over a period of years to break even. This principle of charging what the traffic will bear further operates in that certain high grade products can and must bear high freight charges, whereas, low grade commodities will only move at much lower rates. There are also occasions when, by reason of excess production, or other marketing conditions, such low prices are received for particular commodities that they cannot be economically moved at other than low freight rates, so prices as well as freight rates are depressed notwithstanding that a large volume movement may prevail.

Tanker tonnage, in common with other shipping, has been seriously affected by the present economic conditions, and as of August 1 of this year there were approximately 359 tankers—aggregating nearly 3,220,000 tons—laid up, of which 93 were motorships aggregating about 874,000 tons deadweight. At the time of writing the situation has not improved and the number of tankers laid up for lack of business now is probably greater.

The demand for tanker tonnage prior to 1929 resulted in increasing freight rates, reaching a peak in February, 1930, of $11.70, or 48 shillings, per ton of cargo for a single transatlantic voyage U. S. Gulf/U. K. Continent; from the peak in February, 1930, there was a decided decrease in the demand for tankers, and freight rates rapidly declined until September, 1930, when they reached $2.70 per ton, or 11 shillings. Since then clean tanker rates in the transatlantic trade have remained weak, and at the present time are about $1.80 per ton, or 9 shillings. Other trades have been similarly affected and freight rates are, at the present time, on a most unprofitable basis; in fact, practically few tankers running are earning even their depreciation.

Owners Misled

MANY tanker owners were undoubtedly misled by the demand for tanker tonnage prior to 1929, and assumed that the demand for tonnage was occasioned by increased consumption, where as a matter of fact, large quantities of oil were going into storage; this applies particularly to crude and fuel oil.

The primary reason for the oil companies having their own tanker fleets, is in order to provide the lowest possible transportation costs. Owing, however, to the fluctuation in requirements for transportation, due to seasonal demands, changes in sources of supply, changes in tariff rates, etc., it has been found unwise for oil companies to own tonnage to take care of one hundred percent of their transportation needs, and consequently it has been the practice for the oil companies to only own tonnage sufficient to cover somewhat less than their average requirements, and to charter tonnage in the open market to meet their peak requirements. This has led to the building of considerable tanker tonnage which might be classed as tramp tankers, owned by companies which have no direct connection with oil companies. These independent tanker fleets, which have grown to considerable size in recent years really set the market rates for tanker tonnage, for the reason that the oil companies which do not own tonnage or own only a samll proportion of the tonnage needed, base the selling price for their oil on their costs, including transportation, and consequently the oil companies which own tonnage to transport a large proportion of their requirements are likewise forced to the same basis in fixing their selling price.

At the presnt time, there is a surplus of tanker tonnage, brought about to a great extent by overbuilding on the part of the independent tanker owner, and where these vessels have not been fixed on long term time charter, the owners in their endeavor to keep them running are willing to accept rates, which in most cases represent only the out-of-pocket operating cost and allow nothing for overhead, depreciation and carrying charges. This results in the oil companies' fleets also operating at a loss, in spite of every effort to cut costs, for in the marketing of their products they are in competition with companies who charter tonnage on the open market, and consequently no more can be allowed for transportation in their owned tonnage than the cost of tonnage in the open market. In the final analysis, practically all tanker tonnage is now receiving returns of less than the cost of operation, plus overhead, depreciation and carrying charges.

Supply and Demand

THE question of tanker tonnage supply and demand is one which concerns both tanker owners and oil companies, being the crux of the tanker freight rate structure. The demand for tanker tonnage is governed by the sources of petroleum and its products and their proximity to the refining and marketing centers. This controls primarily the length and direction of the haul; another factor, is the cost of petroleum products and whether products in excess of normal consumption requirements are being transported and put into storage. The demand is also influenced by cross-hauls, due to competition between oil companies. The correct forecasting of the demand for tankers is a problem to be approached with trepidation and which, judging by the history of tanker freight rates, is prone to show surprising discrepancies between the forecasted and the actual demands.

The supply of tankers may be determined with a measure of statistical accuracy, although in this respect all of the tanker tonnage is not available for common service, since some tanker routes are restricted by law to national flag vessels, as for instance, the United

States coastal trade. A large proportion of American tanker tonnage is owned by the major oil companies, and is divided into classes, such as clean vessels, dirty vessels, vessels of limited dimensions or draft, vessels designed for special services, and those designed for the transporting of special products.

In attempting to determine if the supply of tanker tonnage is adequate for normal requirements during the next few years, it is necessary to know, in addition to the probable requirements, the age of existing tanker tonnage, the amount of new tonnage contracted for and under construction, and the nature and amount of tonnage laid up during this period of depression.

Age and Replacements

APPROXIMATELY 12,725,000 deadweight tons of tanker tonnage were afloat as of August 1, 1931. Of this tonnage, 40 percent is over 10 years of age, and 14 percent over 15 years of age. The amount of tonnage under construction or on order on October 1 through out the world was approximately 894,120 deadweight tons, or only about 50 percent of the amount of tonnage over 15 years of age. As stated elsewhere, in this article, nearly 3,222,000 deadweight tons of tankers are laid up, including 93 motor tankers of 874,000 deadweight tons, thus leaving about 2,348,000 deadweight tons of steam tankers laid up, which figure has an interesting relationship to the 1,797,000 deadweight tons of tankers over 15 years of age and doubtless of the smaller and less efficient type of steam tanker.

It is generally accepted that the less efficient, smaller type of steam tanker cannot compete with the large modern motor tanker in the long international tanker route haul during low rate periods. The use of these smaller steam tankers is only feasible in the short haul, coastal trades, where they may have the advantage of limited harbor facilities and national trade restrictions; but even in these trades they will eventually be replaced by more efficient tonnage, of convenient size and type.

It is only in periods of high freight rates that the older and smaller tankers can be operated profitably on the international long haul routes. The majority of these small steam tankers are along in years, and as they have mainly been employed in the carriage of clean products, they may require extensive and costly repairs to hull structure because of corrosion. The cost of repairs necessary to enable these vessels to pass their periodical classification surveys and retain the highest class, if undertaken, will eventually be reflected in the rates which the owners of such tonnage can, as prudent business men, afford to accept.

While there is a most deplorable depression at this time in the oil tanker business, it seems evident that having regard to the age, physical condition and prospective operating costs of the tanker tonnage now over 10 to 15 years of age, the supply and demand of economical tonnage in the next normal period of business will be nearer in balance than at present, and that the large modern motor tankers now under construction will show a very satisfactory return on their investment.

If the period of low rates is prolonged, it will result in the approximate stabilization of rates predicated upon the operating and layup costs of the most efficient and convenient tonnage, and the laying up of the remainder of the tonnage which cannot meet the stabilized low freight rates; this is essentially the situation prevailing at this time, a large amount of tonnage being laid up. A corollary of prolonged low freight rates is an intensive economic campaign to reduce all operating and overhead expenses to a minimum, having regard, of course, to the proper physical maintenance of the vessels.

In the last analysis, the oil companies desire the lowest possible transportation costs and there is no question that over a period of years, this is best attained by ownership of tonnage. It is significant to note that the percentage of ownership of world tanker tonnage by the oil companies as a whole has been declining since 1914, when they owned 65 percent of the total; in 1920—58 percent; 1925—62 percent, and their ownership of the total world tanker tonnage afloat and under construction, as of July 1, 1931, was but approximately 55½ percent.

Failure of oil companies to keep their ownership abreast of the growth of business, stimulated the demand for tonnage in the open market, resulting in a period of high freight rates, which undoubtedly influenced the owners of "tramp" tankers to enlarge their fleets. Over three-fifths of the total of 2,000,000 deadweight tons of tankers recently completed or now on order is for account of these independent owners. This new tonnage has created a major slump in rates, which is a decided advantage to oil companies not owning tonnage, particularly at the present time when tanker rates are, generally speaking, far less than the actual cost of operation.

Stabilization in tanker freight rates will only come when the oil companies control the major portion of the tonnage necessary to meet their requirements.

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Oil Transportation on American Rivers

SHIPMENTS of petroleum products by water naturally cost less than any other form of transportation, and during recent years oil companies serving districts fed by navigable waterways have steadily expanded their water borne traffic, and each year has shown a substantial growth, particularly on the Mississippi and Ohio Rivers of the United States.

The Standard Oil Company of Louisiana has a fleet of ten tugs listed in the accompanying table.

Louisiana Standard's Tug Fleet

Steamers	Indicated Horsepower
Sprague	2400
Istrouma	2385
D. R. Weller	1400
James Moren	1100
Slack Barrett	1200
Corona	1000
Standard	750
McDougall	750
Wanderer II	250
O. F. Barrett	1200

These boats handle a total of 33 steel barges and eight wooden barges, moving petroleum products.

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G. and J. WEIR, LTD., of Glasgow has published recently a 50-page catalog divided into two sections dealing with direct acting and pyro electric fuel oil pressure pumps, oil transfer pumps, forced lubrication pumps, and cargo oil pumps, in the first section and oil data and tables covering pipe friction, specific gravity tables, and detailed graph sheets in the second.

Numerous illustrations lighten the text while comprehensive charts furnish valuable data for oil flow and friction in pipelines.

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Deep Well Drilling, by Walter H. Jeffrey (Gulf Publishing Company, $6.00) is a handbook of information for the engineer and driller, including principles and practices of deep well drilling. The present volume published in the Spring of 1931 is the third edition and following the radical changes in drilling practice and improvement in technique contains practically none of the information included in the first edition published ten years ago.

Geared Diesels For Tankship Propulsion

World's Only Tanker With This Form of Power Completes Four Years Service. Performance to Date Indicates That System Is Worthy of Close Study by Oil Companies.

ONE important objective in the design of an ocean-going vessel is the attainment of high propulsive efficiency from low propeller speed, and this has been one obstacle continuously confronting Diesel power, as with direct drive, low revolutions generally involve excessive weight and cost. By the introduction of reduction gears and flexible couplings a propeller speed of 80-90 r.p.m. is obtained with a medium weight, compact, twin Diesel installation turning at about 275 r.p.m., and the slight power loss in transmission is more than regained in propeller efficiency. The performance of a tanker so equipped is discussed in the following article.

ABOUT four years ago a 10,200 ton deadweight steam tanker was purchased from the United States Government by the Oil Transport Company, who agreed to scrap her reduction geared turbines and Scotch boilers and replace them with Diesel power, which it was estimated would reduce the daily fuel consumpton from over 200 bbl. down to approximately 90 bbl. and simultaneously increase her speed from 9 knots to 10¾ knots, as well as slightly add to her bulk-oil cargo carrying capacity.

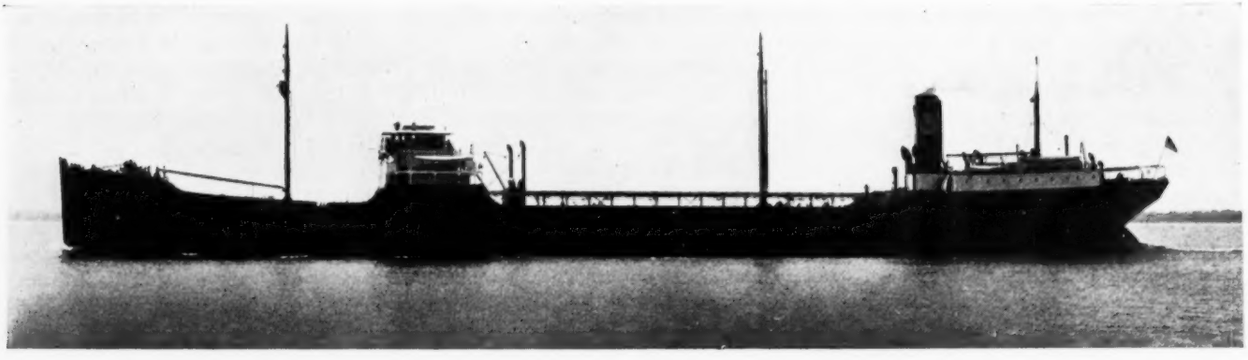
Converting a ship from one form of power to another is usually an expensive process because it often involves structural changes to the hull, including new engine foundations, lineshafts and propellers, and occasionally means shifting a bulkhead. Her new owners naturally were anxious to reduce the conversion costs to a minimum, and after studying the various forms of Diesel power decided that taking everything into consideration geared Diesels would mean comparatively few alterations, and that twin engines could be installed on the existing single-screw propeller shaft.

Although there are many geared Diesel driven vessels including tugs, ferries, freighters, dredges, yachts and transatlantic liners now in service the oil fraternity for no apparent reason, engineering or otherwise, does not seem to have given serious consideration to this system for tankers, as the tankship we are about to discuss is the only one of her type put into commission. Yet the system has many promising features for tanker propulsion, and particulars of four year's performance of a sea-going tanker are now available for study.

Some oil companies have practically all steamships in service and of these, turbines dominate in one instance and reciprocating engines in another. Some companies adhere rigidly to Diesels like the Anglo-Saxon Petroleum Company, the operation of whose fleet was discussed in the January, 1931, issue of WORLD PETROLEUM. One American oil company, the Atlantic Refining Company, during recent years has developed Diesel-electric drive and has adopted it for all its fleet. Other concerns use various forms of power, letting current purchasing and operating conditions be a factor in the decision at the time of ordering a ship.

The geared-Diesel tanker referred to, which is the sole representative of its type in the oil industry, is the old TUXPANOIL, renamed HERMAN FALK upon conversion, and changed to CITIES SERVICE OHIO upon being acquired by her present operators, the Cities Service Transportation Company of New York.

Through the courtesy of C. Story, manager of the Cities Service Transportation Company there is attached a complete table of operating records since the ship has been in the capable hands of her present owners. She operated continuously from February, 1930, until April, 1931, when she was laid up for lack of cargoes, with the exception of a four-day drydocking period in September, 1930. The ship originally had a loaded displacement of 14,746 tons on a draft of 25 feet 4½ inches; is 445 feet long overall, 431 feet b.p. with 59 feet 2 inches breadth and her propeller turned at 90 r.p.m., the designed power of the turbines being 2,800 s.hp.; but the service speed was not more than nine knots. Her present displacement is given as 15,460 tons loaded and 4,500 tons light, and loaded draft 26 feet 5¼ inches. Her fuel capacity is 782 tons and water 150 tons. The maximum cargo carried under the present ownership is 86,282 bbl. (12,326 tons if crude or 10,151 tons if gasoline). This is a very



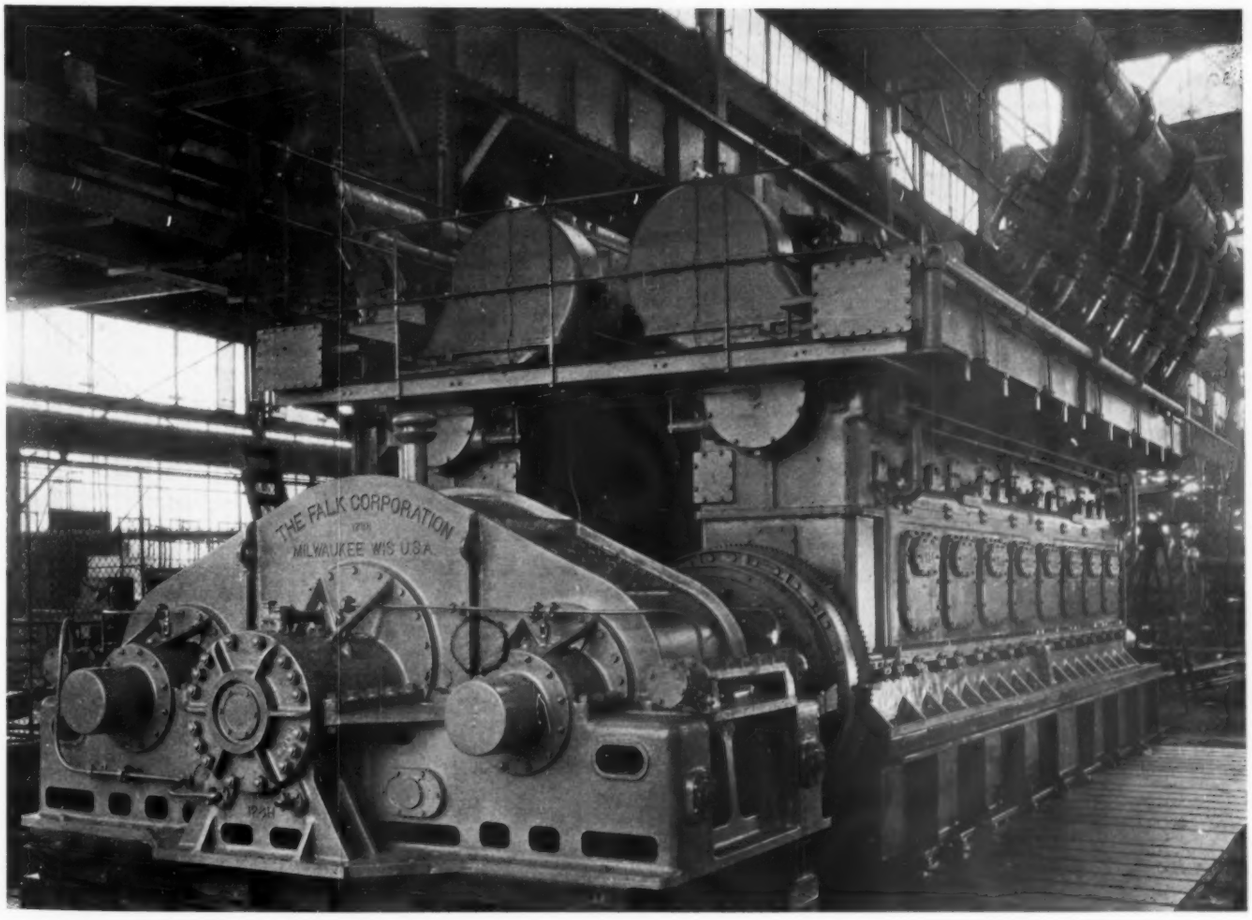
Tanker Cities Service Ohio, the only oil carrier propelled by geared Diesel engines.

substantial cargo for a vessel of her dimensions and power, and it is not surprising that on this voyage she made her lowest average speed, namely 8.2 knots. Her average speed for 21 round voyages aggregating 79,166 sea-miles was 10.1 knots. These figures are worth noting for comparisons with any other form of power in a tanker her size.

For the new power her previous owners decided to install twin eight-cylinder, four-cycle, trunk-piston, airless-injection, type, Falk Diesel engines together developing 2,650 b.hp. at 275 r.p.m. and arranged parallel on each side of the ship's center line in the old engine room aft. The reduction gear and thrust bearing are at the forward end of the engines, so it was necessary to fit two additional lengths of shafting and run them between the engines to make the connection to the old propeller shaft. The reduction ratio of approximately three to one gives the shaft a speed of 90 r.p.m. and enabled the old 17 foot 9 inch diameter by 13 foot 3 inch pitch, four-bladed propeller of 91½ square feet area to be retained. The engine crankshafts are connected by means of flexible couplings to two pinions which mesh with one common low-speed gear. The center lines of the two crankshafts, the two pinions, the low speed gear, and the intermediate shafting are all in one plane. The engine cylinder diameter, by the way, is 18 inches and the stroke 22½ inches. This means very small parts to handle when overhauling or repairing, and that oil or water cooling of the pistons is unnecessary.

Transmission losses are very much lower than with Diesel-electric drive, being less than 50 b.hp. in this case, and the gears cost much less than main generators and motors, working out on this job at $6 per horsepower. On the other hand, with electric transmission first cost and operation of the ship's auxiliaries at sea and in port is much more economical, as power is taken from the main units. With this tank vessel the old steam equipment was for the most part retained, two of the original Scotch boilers being used for this purpose. These boilers consume 24 to 36 bbl. per day at sea, or nearly one-half as much fuel as the two Diesels under full load, as will be seen from the consumption records accompanying this article. Had the ship been intended for the light oil trade all steam units could have been replaced by auxiliary Diesel-electric units, which would be more advisable in the case of a new ship where existing equipment was not available. But the old steam cargo pumps were in good condition and steam was needed for heating heavy cargo. For lighting, and for operating some of the new equipment that was needed in addition to the old pumps, steering gear, etc., a 165 b. hp. 110 kw. Diesel generator set was installed. Its consumption is comparatively small.

When the conversion was carried out no changes were necessary in the structure of the vessel, and all bunker spaces, pump rooms and cargo spaces were maintained as originally built; but new foun-



Reduction gears are placed at the forward end of the engines with the line shaft arranged between the two units.

dations were fitted for the engines and gears. New steam pipes of copper for deck use were installed, and the ship overhauled generally. The entire job took 102 days, and cost (in 1927) $413,615. This was divided as follows:

Cost of Geared-Diesel Installation

	Dollars
Shipyard work	193,520
Main engines and gear	185,000
New auxiliaries	35,095
Total	413,615

The installation is very compact and, for the power and propeller speed of 90 r.p.m., very light, as will be seen from the following details:

Dimensions and Weight of Installation

Main engine length	27 ft. 10⅝ in.
Length engine and gear	39 ft. 1½ in.
Height above crankshaft center	11 ft. 6 in.
Weight main engines, couplings, reduction gears, platforms, ladders, etc.	485,000 lb.
Weight auxiliary Diesel-generator set	29,800 lb.
Weight balance of auxiliaries	33,500 lb.
Weight spare parts	23,000 lb.
Total	571,300 lb.

The complete weight, therefore, is equivalent to 220 lb. per shaft horsepower, of which the two main engines alone represent under 160 lb. per s.hp. as the gear unit weighs 75,000 lb., or 29 lb. per horsepower.

While this article is not intended to form a technical discussion of gear drive, but rather to furnish operating information useful to executives of oil companies for making economic and performance comparisons with their own vessels, a few details of the transmission gear will not be out of place. The gears of the CITIES SERVICE OHIO differ considerably from usual marine reduction gears, being of the rolling-mill type with stub teeth of rather coarse pitch lubricated with semi-fluid compound instead of oil spray. As a result there is no attendant system of pumps, coolers and piping to maintain. The gears operate noislessly even when one engine happens to deliver considerably more power than the other. Mention has been made of the flexible couplings between the gears and the crankshafts. The degree of rigidity of these couplings, also the masses of the comparatively small flywheels, were selected so as to place the two-noded criticals most favorably. The flywheels are virtually rings for the barring gear.

Details of Reduction Gear

Face width of gears	30	in.
Net width of teeth	25	in.
Diametrical pitch	2	D.P.
Pitch circle diameter of low speed gear	76½	in.
Pitch circle diameter of pinions	25	in.
Angle of teeth	30	deg.
Number of teeth (gear)	153	
Number of teeth (pinions)	50	

The present owners of this tankers have experienced no difficulties of any nature with the reduction gears or couplings. During the first year's operation following conversion there was said to be a slight pitting of the gears; but these seem to have settled down as there has been no evidence of any extension of this pitting. During the time the CITIES SERVICE OHIO was laid up for lack of employment the cylinder liners and

Twenty-one Round Voyage Records of the Geared-Diesel Tanker Cities Service Ohio

Voyage	Time At Sea	Time In Port	Time In Dry Dock	Miles Traveled	Barrels Transported	Aver. Speed	Fuel Consumption At Sea (Daily Average) Aver. Rev.	Auxl. Boilers (Bunker C) (Barrels)	Main Engines (Diesel Oil) (Barrels)	Fuel Consumption In Port (Bunker C) (Barrels)	(Total) (Diesel) (Barrels)	Lubricating Oil Consumption At Sea (Gallons)
1 — Light	20Da.18Hr.	.....	.....	4874	.....	10.5	82.0	27.7	114.9	15	183	559
Loaded	23Da.16Hr.	1Da.23½Hr.	.....	4878	82,335	9.5	80.8	24.0	78.5	90	20	658
2 — Light	8Da.5½Hr.	.....	.....	1751	.....	10.3	81.5	29.6	73.2	336	15	180
Loaded	8Da.9½Hr.	5Da.17Hr.	.....	1787	81,210	9.4	80.9	23.6	78.0	140	30	262
3 — Light	9Da.16½Hr.	.....	.....	1787	.....	9.8	80.0	28.3	73.1	290	29	241
Loaded	8Da.8½Hr.	5Da.7½Hr.	.....	1749	81,161	9.4	79.6	33.6	79.0	46	10	365
4 — Light	7Da.19Hr.	.....	.....	1749	.....	10.9	82.3	24.5	78.9	240	20	181
Loaded	8Da.13Hr.	3Da.8½Hr.	.....	1749	81,555	9.7	80.5	24.4	78.9	62	12	247
5 — Light	7Da.8½Hr.	.....	.....	1749	.....	10.6	81.3	25.8	74.6	230	16	214
Loaded	8Da.1Hr.	3Da.15½Hr.	.....	1784	81,502	9.6	79.4	25.6	74.4	30	10	235
6 — Light	8Da.6½Hr.	.....	.....	1959	.....	10.4	82.0	22.1	75.8	94	22	278
Loaded	8Da.8½Hr.	4Da.13½Hr.	.....	1972	81,149	11.3	81.5	15.9	83.9	22	24	264
7 — Light	8Da.1Hr.	.....	.....	1784	.....	10.3	81.5	14.9	77.6	54	14	307
Loaded	8Da.2Hr.	5Da.16Hr.	.....	1749	81,220	9.6	80.2	15.3	83.1	20	14	258
8 — Light	10Da.2Hr.	.....	.....	1749	.....	10.1	80.9	17.5	74.7	160	30	308
Loaded	10Da.3½Hr.	2Da.21½Hr.	.....	1784	81,206	9.4	77.4	19.3	83.8	30	16	400
9 — Light	8Da.0Hr.	.....	.....	1784	.....	10.4	80.9	20.9	77.6	181	26	396
Loaded	7Da.23½Hr.	9Da.7Hr.	4Da.2½Hr.	1749	81,343	9.6	79.4	24.7	79.2	111	22	688
10 — Light	7Da.16½Hr.	.....	.....	1749	.....	10.6	82.1	27.3	82.6	420	30	612
Loaded	7Da.8Hr.	3Da.14½Hr.	.....	1573	81,277	9.9	81.0	26.1	83.4	72	14	514
11 — Light	7Da.8½Hr.	.....	.....	1698	.....	10.7	81.7	26.7	75.1	82	148	413
Loaded	9Da.20½Hr.	4Da.1Hr.	.....	2107	81,608	10.5	81.5	27.3	84.8	102	66	562
12 — Light	8Da.1½Hr.	.....	.....	1749	.....	10.6	80.6	30.9	74.0	96	24	585
Loaded	9Da.3½Hr.	3Da.17½Hr.	.....	1784	81,328	9.2	79.3	28.7	84.9	80	4	601
13 — Light	9Da.0Hr.	.....	.....	1972	.....	10.2	80.0	30.1	82.2	76	19	643
Loaded	8Da.9Hr.	4Da.10½Hr.	.....	1884	82,056	10.6	80.3	32.5	85.0	190	24	731
14 — Light	8Da.10Hr.	.....	.....	1913	.....	10.7	80.9	37.1	79.5	380	34	551
Loaded	9Da.9Hr.	4Da.8½Hr.	.....	2019	82,258	10.4	80.9	35.4	81.9	238	68	487
15 — Light	9Da.2½Hr.	.....	.....	1993	.....	9.7	79.0	33.2	76.7	98	20	531
Loaded	9Da.7½Hr.	3Da.10Hr.	.....	2019	83,018	10.5	80.9	31.2	84.7	216	63	505
16 — Light	8Da.6Hr.	.....	.....	1693	.....	9.9	80.9	32.7	79.1	138	14	487
Loaded	12Da.0½Hr.	2Da.2Hr.	.....	1847	84,560	10.7	81.7	35.0	80.8	130	91	540
17 — Light	7Da.20½Hr.	.....	.....	1913	.....	10.7	81.3	35.5	80.3	89	12	514
Loaded	10Da.23Hr.	3Da.6½Hr.	.....	2019	83,365	10.5	81.1	33.8	82.8	235	58	521
18 — Light	8Da.22Hr.	.....	.....	1993	.....	9.6	80.5	33.6	77.7	90	20	563
Loaded	11Da.3½Hr.	3Da.12Hr.	.....	2019	84,122	10.0	78.5	35.2	81.1	212	37	509
19 — Light	1Da.1½Hr.	.....	.....	139	.....	9.7	80.8	36.7	76.8	96	12	37
Loaded	3Da.4Hr.	4Da.17½Hr.	.....	413	86,281	8.2	77.3	29.6	70.8	161	30	124
20 — Light	8Da.13Hr.	.....	.....	1678	.....	11.0	82.6	36.4	108.3	1341*	101*	463
Loaded	7Da.5Hr.	98Da.8½Hr.*	*	3215	84,332	10.7	77.9	31.6	80.7	250	88	382
21 — Light	8Da.5Hr.	.....	92Da.7Hr.	1597	.....	9.8	81.8	33.2	76.5	155	3	385
Loaded	6Da.23½Hr.	9Da.1½Hr.	5Da.1½Hr.	1390	84,435	10.6	77.2	29.6	76.3	65	76	361
	377Da.2½Hr.	188Da.0Hr.	101Da.11Hr.	80,763	1,731,325	10.1	80.5	28.3	80.6	**7163	†1469	††7662

* Laid up—No cargoes. ** Daily Average 71.6 † Daily Average 17.4 †† Daily Average 46.8

piston rings of one of the twin Diesel engines were renewed. Cost of maintenance on this motorship has been slightly higher than with the geared-turbine steam tankers of her owner's fleet; but she is the first of her type.

It is planned to install an exhaust-gas (waste-heat) boiler and so cut down the consumption of bunker C fuel when the ship is at sea. Her engine-room crew, including boiler-room staff, consists of 12 men.

In the accompanying performance table it will be seen that the CITIES SERVICE OHIO has put up a very consistent performance throughout the 21 round voyages. Cargo, of course, is carried one way only, and the consistency of the propeller revolution speed on light and loaded trips, respectively, is quite striking, the slight variances being due to the differences in displacement and to weather conditions.

It will be noted that her owners give the fuel consumption of the main engines and auxiliary boilers on a daily basis; but for the consumption of the auxiliary boilers in port (Bunker C fuel) and that of the auxiliary Diesel engine in port (Diesel fuel) the totals burned for the duration in port periods are quoted. For the lubricating oil consumption voyage totals are given.

The best voyage performance was a trip of almost 2000 miles at an average speed of 11.3 knots carrying 81,149 bbl. of oil cargo on a daily main engine fuel consumption of 83.9 bbl. or approximately 11 tons, plus the boiler fuel.

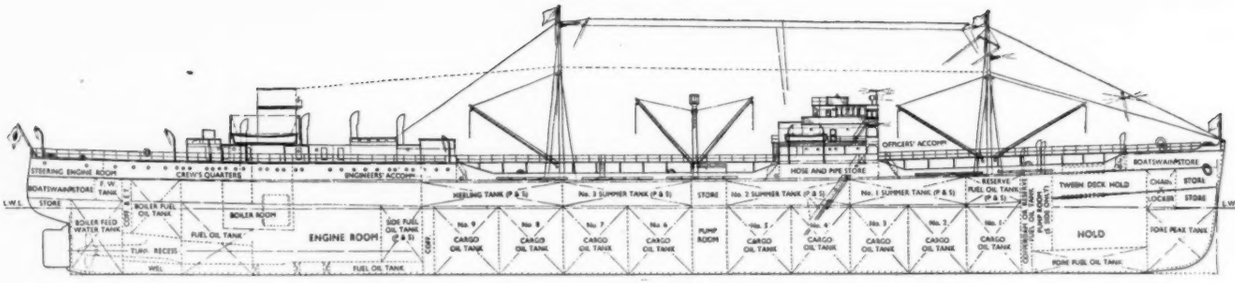
Her owners advise us that an example of the flexibility of the installation was demonstrated on the 22nd voyage, not shown in the table. A slight mishap, caused by a defect in a bolt put the port engine temporarily out of commission. It was disconnected and the ship proceeded towards her destination at 6.2 knots. Meanwhile, due to the small size of the engine parts her engine-room crew readily installed a new piston, connecting rod and liner; then the port engine was cut in and the ship increased her speed to 10 knots. Upon arrival in New York an examination disclosed that permanent repairs could be postponed until a more convenient time, as the ship was allocated for further business.

▼

World's Fastest Tanker Owned by Japan

New Diesel Tankship Teiyo Maru on Recent Trials Attained 17½ Knots Speed Light and 16 Knots Loaded. Waste Exhaust Gases Utilized for Auxiliaries at Sea.

IN view of the present tendency towards faster bulk-oil carrying ships, which if it gains headway when further vessels are built may result in making many existing fleets virtually obsolete, the tanker TEIYO MARU recently completed for the Nippon Tanker Company Ltd. of Tokyo, Japan, is outstanding as the fastest of her type in the world. Nevertheless, she is not seriously regarded by marine officials of major oil companies as likely to set a new precedent in ocean transportation of petroleum, as it is believed that she is really intended as a naval fuel supply unit in the event of war, and that a very high-powered tanker represents too great an overhead for ordinary commercial operation. But, apart from the somewhat larger engine-room crew needed than with a lower-powered ship her actual operating costs will not be high, as by using Diesel engines for propelling power and waste heat for auxiliaries she burned less than 37 tons of oil fuel for all purposes per 24-hour day when running at 16.74 knots with a loaded displacement of 18,797 tons. This compares—if a fair comparison can be made—with a consumption of 160 bbl. (21.35 tons) for the latest, and one of the larg-



Longitudinal section of the Teiyo Maru

Courtesy The British Motor Ship

est, steam tankers of a well known American oil company's fleet, a vessel of 25,750 tons loaded displacement and 11¼ knots speed on a summer draft of 33 feet 7½ inches, regarded as the last word in modern oil-carrying vessels, and said to be the most economical under American flag. The light trial speed of the TEIYO MARU on 8,480 tons displacement was 17.53 knots, and she can maintain a service speed of 15 knots loaded although originally intended to be a 14-knot boat.

The TEIYO MARU, 12,300 tons d.w.c., will operate between the United States and Japan as well as in the Japanese coastwise service, and is one of a fleet of three tankers, the others being the SHOYO MARU, 10,800 tons d.w.c. 12½ knots and the ZUIYO MARU, 10,000 tons 12 knots, all built by the Yokohama Dock Company Ltd. of Yokohoma.

General Dimensions of m. t. Teiyo Maru

Loaded displacemt. on 26 ft. 7¼ in. draft	18,797 tons
Light displacemt. on 14 ft. 1¾ in. draft	8,480 tons
Power of main engines at 125 r.p.m. (Normal load)	7,200 s. hp.
Power of main engines at 135 r.p.m. (Overload)	8,624 s. hp.
Length overall	508 feet
Breadth moulded	64 feet
Depth to upper deck	39¼ feet
Loaded draft, summer freeboard	28¼ feet

Trial speed, light	17.53 knots
Trial speed, loaded	16.74 knots
Service speed, loaded	15.00 knots
Cargo pumping capacity per hour	1,200 tons

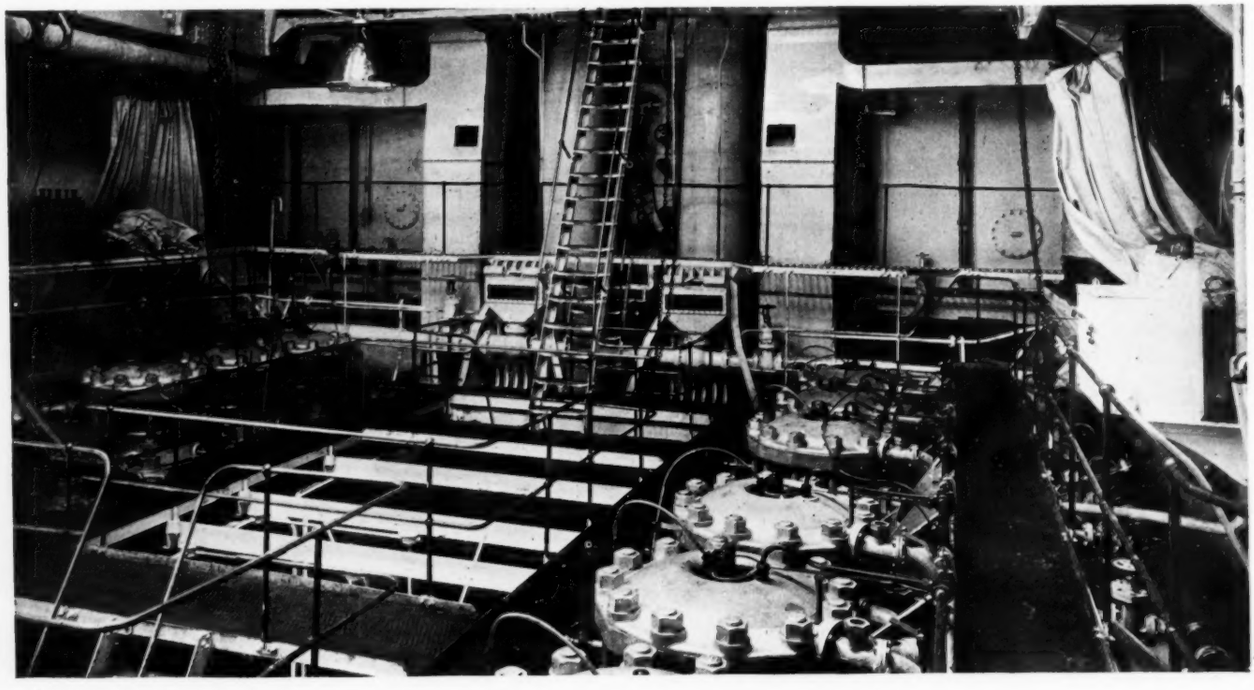
Her propelling machinery was constructed by the shipbuilders under German license, and consists of twin Yokohama-M.A.N. two-cycle, airless injection Diesel engines, each engine having six double-acting cylinders of 600 mm. diameter, with a piston stroke of 900 mm., and is of the same design and power as those which have been supplied by the builder for two motor cargoships. But, in this case, the cylinder scavenging pump is directly fitted to the main engines instead of utilizing turboblowers driven by separate electric motors. The scavenging pump of each of the TEIYO MARU engines has two pistons arranged in tandem and is driven by a crank at the forward end of each engine.

All auxiliary machinery in the engine room and on deck is driven by steam, except the engine room ventilating fan, which is electric. As this tanker has a large pumping plant with a capacity of about 8,400 bbl. oil per hour, consisting of four simplex steam pumps, three comparatively large steam boilers are installed for power supply. Each boiler is fitted with three of the builder's patented oil-burning furnaces, and plate type air preheater. Twice as much heat as with an ordinary tube-type preheater is absorbed from the exhaust gas, and the air temperature was raised up to 302 degs. Fahr. during the trials.

The Diesel exhaust-fired, or waste heat, boiler is of the builder's patented combined water-tube type; one furnace at the center being arranged for oil burning, while two tube nests at both sides are for the Diesel engine exhaust. The exhaust gases pass from back of the boiler and then to the stack. Only the exhaust boiler is used at sea to supply necessary steam to all auxiliary machinery. In this way, two to three tons of fuel oil is saved per day.

Regardless of the TEIYO MARU'S high power and speed no vibration was felt anywhere during overload trials, owing to perfect engine balancing and strength uniformity.

Over 8,000 horsepower is packed into the engine room of the Teiyo Maru.



Methods for Improving Tanker Speed

How Recent Refinements in Designs of Hull Form, Propeller and Rudder Design and Mechanical Steering Equipment Have Increased Ship Speed Is Discussed by John Tutin, B. Sc.

POSTWAR development in tanker design has found its noteworthy feature in the progressive increase in speed year by year.

With the aid of super-chargers, high pressure steam and other modern devices, the speed of an existing ship can be considerably increased, but to achieve this it is of the utmost importance that certain obvious precautions should be taken in the original design such as provision for a substantial increase in the diameter of the main propelling shaft, so that in the event of additional power being transmitted through the shaft, the Classification Society will not insist on new shafting and bearings being installed throughout.

Hull Form

THE higher the speed the more important it becomes that every effort should be made to secure the last ounce of propulsive efficiency, because a high speed means that the propulsion costs absorb a larger proportion of the freight earnings. Consequently it can hardly be considered good practice to contract for a new tanker without specifying that the hull is to be tested in a recognized experiment tank. It is not sufficient merely to provide for hull tests because it is now well known that of two models, the one with the least resistance may not necessarily be the one which requires the least b.hp. for propulsion. It is therefore necessary to specify tank tests with a "selfpropelled" model. This means that the model hull will be fitted with a model screw driven from an internal shaft within the model, while the rudder and other appendages will also be in position. In this way the actual b.hp. for propulsion at any speed can be determined with considerable accuracy. The cost of these tests varies somewhat between the different tanks, but in Great Britain a comprehensive series of tests should not cost more than say £200.

During the past five years the performance of the normal ship form has been considerably improved. This does not mean that it is possible to dispense with tank tests: it simply means that a proposed model is likely to undergo less drastic modification when submitted to the tank authorities for testing.

Apart from the foregoing experimental improvement of normal ship forms, special hull types have been developed, notably that known as the Maier form. So far as the writer is aware, this form has not been used for tankers, its application having been limited to passenger ships, high class cargo vessels and trawlers. Tankers and tramp steamers have forms of a fullness which does not lend itself to securing the maximum gain from the adoption of the Maier type of hull. On the other hand on a high speed tanker the Maier form would certainly be ideal, because the one serious objection to it for cargo vessels, namely the triangular hold spaces at the ends of the vessel, would not arise in the case of a tanker. Further, the additional stability also would be a distinct advantage. In short, any owner who contemplates the construction of new tanker tonnage, and who envisages the possibility of having to operate eventually at speeds of 13 knots or over, should give careful consideration to the desirability of making some departure from the othodox form.

Twin or Single Screw

IN determining whether to adopt twin or single screws, the most important consideration is the limiting draft in its relation to the propeller diameter. If the draft is such that in the load condition a single-screw can be designed which will have a tip immersion of not less than 5 percent of the draft, absorbing the b.hp. of the motor at the correct r.p.m., then it may be said that single-screw propulsion should be adopted in preference to twin-screw.

On the other hand, particularly with shallow draft vessels of a well known type having a large beam in relation to the length, a full block coefficient and a relatively high speed, it might be quite impracticable to provide a single-screw arrangement without adopting unduly high r.p.m. in order to reduce the propeller diameter sufficiently to keep the tips immersed. This means inevitably twin screw installation, which is also an advantage in manoeuvring.

Propellers

IT is a surprising fact that many owners still decline to incur the additional expense of bronze propellers in view of the serious losses which may result when the surface of a cast iron propeller becomes roughened. It is no exaggeration to say that after twelve months service, the efficiency of a cast iron propeller may be so impaired as to cause a virtual loss of b.hp. of the order of 10 percent. It is well to use a cast iron propeller on the trial trip and first load voyage, when accurate data will be available to enable the final bronze propeller to be designed. This does not involve additional expenditure, because the cast iron propeller can subsequently be carried as a spare.

It is generally considered that not much is to be gained by departure from a uniform face pitch, but there is no doubt that the judicious use of an appropriate aerofoil blade section may give an acceptable gain of two or three percent, though it is dangerous to do this without expert advice.

Another feature of modern development in propeller design is the provision of a high rake. Rake is measured by the angle between the axis of the blade and the vertical, measured in a fore and aft direction. With a large rake the propeller blades are carried farther, as in the case of a single-screw vessel, and in the case of a twin-screw vessel the rake increases the clearance between the tips and the hull.

Bronze propellers being admittedly expensive items, there is a natural tendency on the part of the owner to go in for built up propellers having each blade separately bolted to the propeller boss. This results in a boss of very much larger diameter than in the case of a solid propeller, and this big boss is responsible for a relatively serious

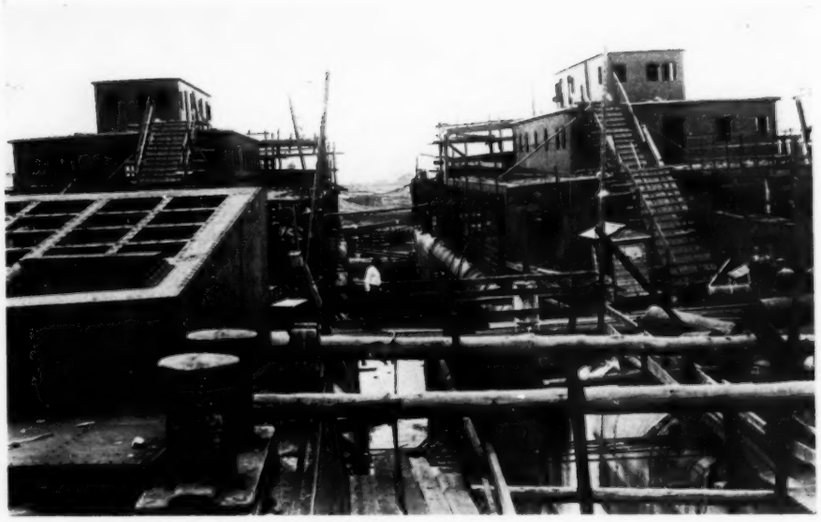
loss in efficiency, particularly when it is remembered that a large diameter boss makes it extremely difficult to find room for a cone of a fore and aft length in proportion to the diameter of the boss. In short, not only does the large boss produce more serious vortex at the centre of the screw, but it is also more difficult to control the vortex by means of a cone.

Rudders

CHOICE of the most suitable rudder is largely dependent upon whether the vessel is to be twin or single-screw. If twin-screw, the most logical type of rudder is the unbalanced streamlined type, which is virtually a continuation of the lines of the after body of the vessel. The sternpost is designed to form a concave socket into which the streamlined rudder fits snugly. In this way, when the rudder is put over, large pressures are induced on the deadwood at the head of the rudder, and the effect is considerably amplified. If there is anything in the nature of a gap between the leading edge of the rudder and the hull, this important effect is lost.

An unbalanced streamlined rudder is equivalent to a virtual increase in the displacement length of the ship, and this accounts to some extent for its propulsive value. It may be mentioned as a matter of interest, that the new Cunarder at present under construction on the Clyde is being fitted with this type of rudder.

For twin screw tankers of shallow draft and big beam, there is a very strong case for twin rudders. With a single rudder adequate steering power can be obtained only by the provision of abnormally large rudder area. This is unsatisfactory and wasteful, because a 20 percent increase in rudder area under such circumstances usually will give only about 5 percent increase in manoeuvring power if measured by the ship turning moment.



Diesel-driven tankers under construction at the Sormovo shipyard in Soviet Russia.

Twin rudders should be placed immediately behind the screws, and they should then be of the reaction type, designed to take advantage of the inevitable rotation which the propeller produces in the slip stream.

The reaction type of rudder is a logical development of postwar progress in rudder design. The rudder is not merely balanced and streamlined, but it is designed to recover the rotational energy which is imparted to the slip stream by the propeller. With a righthanded screw the flow impinges on the port side of the rudder above the axis and on the starboard side below, the angle of impingement with a flat plate rudder being of the order of 30 deg. Applying the same principle as that of a yacht sailing into the wind, the upper half of the rudder can be inclined at an angle of say 15 deg. to port, and the lower half at a corresponding angle to starboard, and in this way the rudder develops a forward force or "reaction" which provides an auxiliary thrust for propulsive purposes.

Ship Oscillations

IN other than smooth water the oscillations of the vessel involve a serious loss of propulsive efficiency. These oscillations may take place in the three principal planes familiarly known as pitching, rolling and yawing.

The amplitude of pitching can be controlled to some extent by "flair" at the bow, but it is a matter of compromise, because too much flair would almost bring the ship to a standstill on the downward swing in a heavy sea, while too little flair would produce a very "wet" ship, and would also produce excessive immersion at the bow. There is a happy medium in this matter which must essentially be determined by experience.

Rolling undoubtedly produces a loss of speed, but not of quite the same extent

Western Sun, 13,500 dwc. built for the Motor Tankship Corporation, Philadelphia, at the Sun Shipyard in Chester. Power, 3000 s.hp. opposed-piston Diesel.

as pitching. On a tanker, little can be done to control this, other than by the provision of more efficient bilge keels. There is a recent invention providing for "intercostal" bilge keels of a streamlined type which undoubtedly would be more effective in checking rolling than the conventional pattern consisting of a bulb angle plate attached to the bilge with a T bar.

On an existing ship, provided the capital expenditure is not excessive, yawing can be very largely minimised by a gyro pilot and a straighter course maintained. This has the disadvantage that the gear is in almost continuous operation. The helm manoeuvres are reduced in amplitude, but increased in frequency, and one must therefore be prepared for an increase in the rate of wear of moving parts in the rudder and in the steering gear.

Straight Steering

A MORE logical method, but applicable mainly to new tonnage, is to insist on a design of rudder which will give a high degree of directional stability to the vessel. A number of highly efficient rudders for this purpose have been developed of recent years, as for example, the Oertz, Simplex, Star, Contra and Balanced Reaction rudders.

It is evident that in order to secure the full gain from a modern rudder it is of importance that an experienced helmsman should be kept at the wheel. With the old-fashioned flat-plate rudder, little or no steering effect is obtained for a helm movement up to about three degrees to either side of the midships position, with the result that perfect steering is not given much attention on a vessel so equipped, for the simple reason that it is impossible. On the other hand, any modern patent rudder will enable a good helmsman to keep his vessel on a dead straight course with periods of say five or ten minutes when the wheel is absolutely still.

If the ship yaws and swings say five degrees off her course, the vessel is instantly exposing her broadside to a flow of water which will impinge at a mean angle of five degrees, thereby causing a very serious increase in resistance. It is thus obvious that a most desirable adjunct to a good rudder is a reliable and sensitive helm indicator, graduated in one degree intervals. With such an instrument in front of him on the bridge, the helmsman is encouraged to keep the actual helm angles as low as possible, and this work is facilitated by his being able to see at a glance the actual helm angle at any instant.

This question of steering is of peculiar importance as far as tankers are concerned, because the inevitably free surface, small though it may be, has the effect of reducing the directional stability of the vessel, and consequently yawing tendencies are accentuated.

Reference may here be made to the fact that Lloyds Register of Shipping insist that the rudder head of tankers should be 10 percent greater in diameter than for an ordinary cargo ship. Thus of two vessels of identical dimensions and speed, having the same rudder area, the vessel which carries oil in bulk has a 10 percent larger upper stock than the vessel which carries a cargo such as grain or coal. It appears that the reason for this is purely statistical, there having been on the average, a larger percentage of rudder and steering gear breakdowns on tankers than on ordinary cargo ships.

Steering Engine

IT can be stated with some certainty that tankers of the immediate future will be equipped with steering gears of very much smaller size, weight and cost than the steering gears fitted to their immediate predecessors. This is partly due to the successful introduction of properly designed balanced rudders. In preparing specifications where a balanced rudder is provided for, a sound method of determining the size of the steering gear is to specify that it should be of a power capable of operating the unbalanced portion of the rudder. This ensures a considerable reduction in size of steering gear, coupled with a certainty that it will operate balanced rudders more rapidly than the corresponding full sized gear would operate an ordinary unbalanced rudder, and in addition there will be a reserve of power

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France's Importing Licenses

THE French Ministry of Commerce sanctioned the new tri-ennial refined products importing licenses on September 29 last. Although these have nothing whatsoever to do with the licenses to import crude oil (granted on April 4, 1931 as reported in WORLD PETROLEUM for May) in some cases certain products authorized to be imported under the refined products act, will be supplied by the company's refinery, when in existence, if the said company has licenses to import both crude and refined products.

Close examination of the different totals for 1929, 1930 and 1932 do not show any very great difference in the percentages allowed each company for importation. They have nearly all been slightly reduced, although the actual quantity of products each company will import, has been increased to meet accrued consumption. This is partly due to new beneficiaries on the list.

The manner in which the O.N.C.L. has divivided up the total of 3,702,850 metric tons of petroleum products necessary for French consumption during 1932 is analized in the accompanying tables.

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Portable arc welding units for field work.

French Refined Importing Licenses for the Year 1932

(Conversion ratio 1 metric ton to 7 barrels)

	1932 (Bbls.)	1930 (Bbls.)
Ste. Franco-Americaine de Raffinage	5,581,100	4,779,880
Ste des Petroles Jupiter	4,125,100	3,152,800
Desmarais	2,963,800	2,377,900
Ste Generale des Huiles de Petrole	2,552,900	1,857,100
Cie Industrielle des Petroles	1,438,500	1,136,800
Lille Bonnieres Colombus	1,145,200	936,300
Les Consummateurs de Petrole	627,900	598,500
Petroles, Essences et Naphtes	600,600	638,750
Raffinerie de Petrole du Nord	592,900	521,500
Ste Francaise de Raffinage	515,900	.....
Comptoir Syndical Cosyndis	416,500	455,000
Ste Francaise des Carburants	394,100	455,000
La Toneline (Franco Egyptienne)	381,500	270,900
Cre Minier Franco Roumain	329,000	192,500
Alsacienne des Carburants	310,800	114,800
Belpetrole	307,300	294,000
Ste Commerciale des Carburants	284,200	266,700
Ste Fse des Combustibleo Liquides	267,400	175,000
Petroles du Languedoc	250,600	175,000
Petronaphte	245,000	245,000
Vacuum Oil Cy	228,200	207,200
App. Consomm. d'Huiles Combust.	224,000	133,000
Pechelbronn	210,700	234,850
Cie Meridionale des Petroles	190,400	175,000
Cie des Huiles Sinco	184,800	152,600
Cre. General des Petroles	177,800	178,500
Texas Company	161,700	116,900
Carburants et Produits de Synthese	127,400	119,000
Huiles Goudrons et Denives	121,800	119,000
Union des Importateurs du Nord du la France "Unicon"	117,250	117,250
Steaua Francaise	105,800	.....
Redeventza	101,500	101,500
Champenoise des Carburants	86,800	67,900
Etablisseements Veuve Bose	74,200	67,200
Modiano	63,700	50,750
Huilerie Centrale	56,000	67,900
Oil Francaise	56,000	56,000
Union Francaise des Produits de Petrole	51,100	41,650
Hamelle	50,400	50,400
Carburants Excelsior	48,300	33,600
La Motoline	35,700	34,300
Ste des Oleonaphteo	35,700	50,400
Ste Nouve des Huiles Minerales	33,600	.....
Ste Naphta "Rapide"	32,200	28,700
Brest Port Petrolfier	15,400	.....
T.C.R.P.	.....	140,000
Produits Chimiques et Raffinage de Berre	.....	406,000
Raffinerie Petrole de le Gironde	.....	224,000
Petrofina	.....	58,800
Diebolt	.....	48,650
Ste Francaise des Huiles Minerales	.....	33,600
Total	25,919,950	21,752,080

Tanker Underwriting a Profitable Risk

Oil Company Tankship Owners Take Pride in Operating Bulk Oil Carrying Vessels as Free of Insurance Claim as Possible.

By Douglas King-Page

To the underwriter and to the shipowner, the tanker is in a class apart from other ships, bringing its own problems and offering even today a comparatively new field for study. Early tankers are beyond the scope of the writer's personal experience, but it is to be imagined that underwriters regarded them with the same suspicion as, until recent years, they regarded vessels with internal-combustion engines. Now tankers are amongst the most sought after risks in the market, especially when operated by recognized good ownerships. It is significant that underwriters will compete for tankers of other flags by cutting rates far below the safety line, a fact which has done neither tankers as insurance problems, nor underwriters as individuals, any good.

The difficulty with regard to the insurance of tankers is not so much a question of rating as of dealing with claims. If a tanker has been ashore or in collision, and definite and specific damage has been incurred, no difficulties arise. If a tanker comes up for periodic survey and certain damage is discovered, there is immediately a case for dispute whether the damage is attributable to wear and tear or whether it is due to a maritime casualty. There are few instances when, on coming up for survey, a tanker has so clean a record that any damage discovered must necessarily be due to wear and tear.

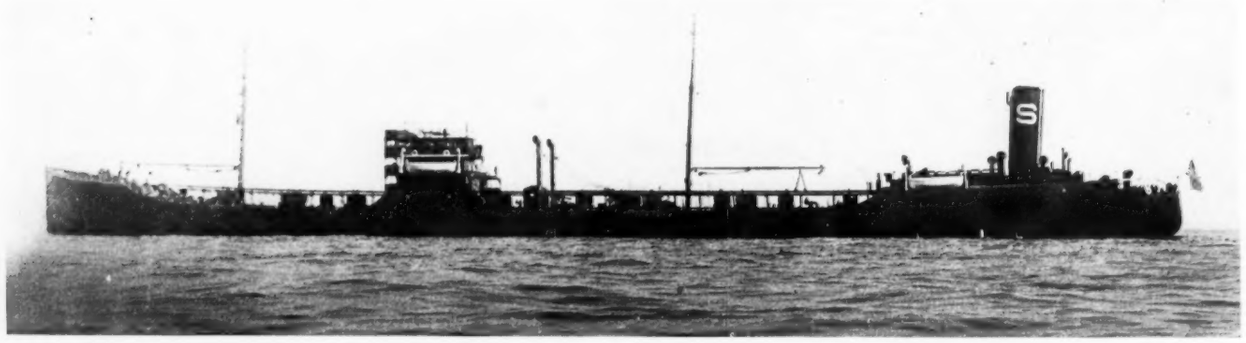
Wear and tear is not covered by the marine policy, and so it is to the interest of the owner to attribute any damage that is discovered to a maritime casualty. Practically every voyage tankers undergo a certain amount of straining, particularly on ballast voyages; but since thorough examination involves cleaning and steaming, and is expensive, they are generally run for several voyages before a survey is carried out. If a claim for damage repairs is then made, the vessel is surveyed by experts appointed by the Salvage Association on behalf of underwriters, and the damage is divided under two headings (a) damage which can be allocated to the respective voyages, and (b) unallocated damage. Under this latter heading the main item is generally the renewal of caulking of rivets and seams, and this is generally apportioned by the surveyor over the various voyages run since the last survey. Expenses which are common to all marine damage, such as the cost of drydocking, steaming and cleaning the tanks, and hammer and water testing, are then apportioned by the surveyors in proportion to the extent of damage definitely allocated to the various voyages.

One result of this method of procedure is that the cost of repairs which would not have been recoverable, since the three percent franchise of the policy was not attained, become recoverable because of the addition of a proportion of the unallocated damage. Sometimes unallocated damage is apportioned to voyages on which (since the franchise is not reached) no claims arise.

In the circumstances under which tanker surveys are carried out, underwriters may be called upon to pay for damage which is really wear and tear. If, for instance, a tanker has grounded lightly, damage actually the result of straining in heavy weather may be argued to have been caused by the stranding.

Fortunately, the bulk of tankers of all flags are owned by reputable owners with some pride in running their vessels as free of claim as possible, and it is not generally difficult to arrive at an amicable settlement by a little give and take on both sides.

One distinct advantage appears to be enjoyed by oil tankers, in that they seldom founder as a result of heavy weather. Until comparatively recent years there was no known case of a "missing" tanker; but this can no longer be said. Explosions on tankers in commission are rare, probably because of the great danger and the consequent careful observation of precautions. In recent years there has been a considerable diminution in the number of explosions



Single-screw tanker Brilliant, owned by the Standard-Vacuum Transportation Company, New York, and built by the Sun Shipbuilding & Dry Dock Company. She is 13,500 tons dwc.

reported on tankers under repair. At one time such accidents were frequent, and although on enquiries being made it was always asserted that extreme care had been taken, there was usually a strong suspicion that either the tanks had not been properly cleaned before work was started, or that workmen employed on the job did not observe the strict regulations against smoking.

Some tankers are employed carrying molasses in bulk, and the writer has a personal theory, possibly quite erroneous, that this is a harzardous trade. Vessels employed in this trade have brought heavy claims at times, and while this may be because often the vessels are old and perhaps past the time when they can carry spirit in safety, there is also the possibility that so heavy a cargo as molasses places too great a strain on rivets and seams, especially in very heavy weather.

It has been said that tanker fires are comparatively rare. When they do occur, they naturally are serious; indeed, it must be an awe inspiring sight to see a vessel full of inflammable liquid blazing at sea. Tanker fires do not necessarily mean total loss of the vessel, as fire does not seem to work nearly so much havoc as in a vessel carrying coal in bulk, or laden with copra and palm kernels. In one case a fully laden tanker blazed for days outside an American port where she was towed to prevent the fire spreading to other vessels, and yet she was not a total loss. During the past few months, at least two instances have been reported of tankers bound across the Atlantic and abandoned by their crews when fires broke out; but the fires were conquered and the crews rejoined their ships.

Tankers are a rather fascinating underwriting proposition, feminine in their allure of danger and their promise of reward. Tanker rates are low, but a careful selection of risks should yield the expert underwriters good profits in a normal year. If at times an inevitable loss has to be paid, it is all in the game.

Nothing has been said as yet of the cargo risk presented by tankers. It may be observed that the cargo carried in tankers offers an entirely different risk to the hull. If a tanker strands, what is more easy than to lighten her by jettison? On the other hand, if place and weather permit, what is more simple than lightening by transhipment? The oil laden tanker carries almost inexhaustible material for smoothing broken seas—at the underwriter's expense, while in collision, tanker cargo is as likely as not to suffer severe loss.

To the consumer of oil, there is one feature of tanker insurance which must appeal. It is cheap, and adds very little to the cost of carriage. If some statistician would take the trouble to work out this problem, it would probably be found that the cost of insurance per ton per mile was an infinitesimal fraction of the smallest known coin.

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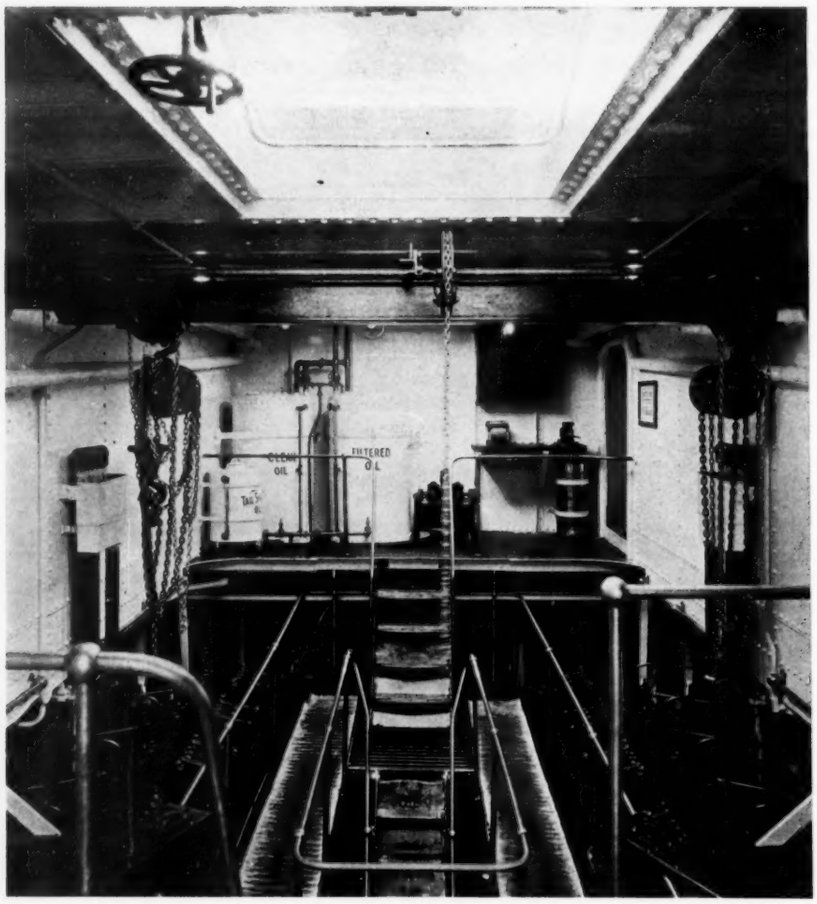
Troy Socony class of Diesel-driven canal tanker

Power Tank Barges for Canal and Coast

Problems Encountered in Developing a Fleet of Motor Tankers for Canal Work in Warm Weather and Coastwise Service During Winter Months. Buffalo-Socony Sets an Operating Record.

WHEN the New York State barge canal was completed for service between Troy and Buffalo in 1918, a new era was opened in the United States for inland waterway transportation. The canal traverses a territory rich in natural resources and thickly populated, which is conducive to the extensive use of the automobile, bus, motor truck and tractor, all requiring gasoline. Quickly realizing the importance of the wonderful engineering skill which provided the canal, the Standard-Vacuum Transportation Company—to whose courtesy WORLD PETROLEUM is indebted—placed in service the first year of canal operation, non-propelled tank barges towed by steam tugs. From the operation of these barges considerable information was obtained for the design of self-propelled barges for carrying petroleum products in bulk.

It may appear strange to an oil executive whose particular duties do not bring him into close contact with the transportation of the petroleum business, that data and experience should be required before designing a type of vessel for canal use. He can realize, however, the difficulties to be overcome by the designer by considering the fact that the canal as constructed has limited dimensions and limited period of use due to winter freezing. A vessel must come within these dimensions for service on



Engine room of a Troy Socony class of canal Diesel tanker.

the canal eight months of the year, and also be useful for other service during the four months of the year the canal is closed to navigation, in this case coastwise, Long Island Sound, New York State, or harbor service. Limits of clearances under the bridges of fifteen feet and a depth of water over the sills of locks of only twelve feet restricts the depth of the vessel to low freeboard and low head room for any structures above deck, making oil engines ideal power.

The first attempt to design a vessel meeting these conditions resulted in the building of five vessels, the first one of which traversed the canal in the fall of 1920, proving definitely that no mistake had been made in judgement as to size, power and other details. These were the Buffalo-Socony class of power tank barge.

Suddenly demands for bulk deliveries, however, urgently required greater tonnage on an increasing scale. Economy and practicability dictated that the demands could be met by placing an order for one new barge and lengthening the BUFFALO SOCONY class. In 1923, forty feet addition (two twenty-foot cargo tanks) increased the overall length to 196½ feet and the capacity to 5,100 bbl. of 50 U. S. gal. each.

General Dimensions of Pioneer Fleet

Length overall	156 ft. 6 in.
Length between perpendiculars	150 ft. 0 in.
Beam	29 ft. 6 in.
Depth to main deck	12 ft. 6 in.
Capacity (on canal draft of 9 ft. 6 in.	4000 bbl..

So successful were these barges that during the season of 1930, one of them established a record of operation, having made a total of 121 trips, 60 of which were loaded and 61 of which were light. The vessel was 120 days in transit with cargo covering a distance of 8,687 statute miles and 97½ days in transit without cargo travelling a distance of 8,658 miles. Her propelling machinery is a single screw six-cylinder directly reversible gasoline engine, developing 300 s.hp. The cargo pumps are horizontal duplex type driven by 50 b.hp. gasoline engines in separate compartments. A 10 k.w. gasoline generator unit provides current for steering gear and lights. On the bow of each vessel is located a large floodlight controlled entirely from the bridge deck amidships for use in the canal at night. Location of the pilot house and bridge deck amidships is a feature of great importance with respect to canal navigation in that the helmsman is far enough back from the bow to

Oil tow-barge passing a Diesel freighter in the New York State Canal.

readily ascertain the swing of the vessel in places where a slight swing or change of direction would mean so much in keeping off shallow places as in the canalized rivers and around curves and bends in the channels. Three of these boats were changed to Diesel power at the time of lengthening.

While their increased capacity met the demands for canal service, these vessels could not compete economically with vessels of larger capacity and capable of extending their voyages greater distances. Then again the State improved the canal at many places which before were difficult to navigate. During the time the lengthening of the BUFFALO SOCONY class was going on, there was under construction a bigger power tank barge—the TROY SOCONY—which was placed in commission in June, 1923.

The general dimensions of the TROY SOCONY are 254 feet length overall, 37½ feet beam and 14 feet depth, with a capacity on canal draft of 9½ feet of 7,800 50-gal. bbl., and when loaded to 12 feet draft for service on harbors, rivers and sounds, of 12,000 50-gal. bbl. This barge being larger than the BUFFALO SOCONY class, it was deemed advisable to install twin engines. As the Diesel oil

Buffalo Socony before lengthening.

Buffalo Socony, which made a record on the N. Y. State Canal during 1930.

engine had reached the stage of perfection considered necessary for good operation, two 300 s.h.p. engines were installed.

Twin rudders greatly aided the manoeuvering qualities of this vessel in negotiating sharp bends, and together with the twin screws, it was found that the more or less exposed positions were not subject to excessive damages by coming in contact with the sloping banks of the canal. The direct reversible engines again proved faultless. It did not require very long to decide that additional vessels when required could be made larger and still have the necessary qualities for efficient and safe navigation in the restricted parts of the canal.

Continued increase in canal business was sufficient to warrant the construction of additional barges. Eight barges were contracted for late in 1923. They were all completed and in service by May, 1924.

General Dimensions, 1924 Class

Length overall	260 ft. 9 in
Beam moulded	40 ft. 0 in.
Capacity (canal draft of 9 ft. 6 in.)	8,100 bbl.
Depth	14 ft. 0 in.
Capacity	13,500 50-gal. bbl.

These also have twin Diesel engines and twin rudders like the TROY SOCONY. Cargo pumping equipment consists of electric motor-driven geared duplex pumps, the power being generated by Diesel engine driven generators in the engine room. All auxiliaries are electric, including the galley range.

These barges have been in service seven years and have proved most satisfactory in every respect. When the canal is closed to navigation, they supplement the service of larger vessels making deliveries up and down the coast from Philadelphia, Pa., to Bangor, Me. They also tow non-propelled barges between New York and Albany.

The engines are so arranged that manoeuvering is accomplished with the least possible effort. All the controls for starting, speed, injection air, starting air and telegraphs are brought to one point, enabling the engines to be controlled with greatest possible speed. The main engines are direct connected to the propellers, which is another point in efficiency in that there are no transmission losses; full power of the engines is obtainable ahead and astern.

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Argentine Petroleum Industry, 1930

THE official statistics of the petroleum industry in the Argentine Republic, issued by the Direction General de Minas y Geologica, show the total production of crude oil by districts:

Production by Districts

District	Production (bbls.)
Commodoro Rividavia	8,173,492
Plaza Huincul	1,498,119
Salta	327,075
Mendoza	3,115
Total	10,002,251

Of this amount of oil 5,796,091 bbl. were from wells under government control and 4,206,160 bbl were from private wells.

The number and condition of the oil wells in the two principal producing districts as of December 31, 1930, are given as follows:

Wells in Principal Districts

Wells	Comodoro Rividavia	Plaza Huincul
Producing oil	1414	142
Producing gas	56	10
Boring	66	16
Abondoned	285	60
Shut down	209	30
Being equipped	42	7
Total	2072	265

Statistics of casing head gasoline production show that 170,197 bbls. were produced.

The total number of men employed in the oil fields, as of December, 1930, was 6,100, of which 3,824 were in the employ of the Government.

Crude Petroleum Treated in Argentine Refineries

	1929 (bbls.)	1930 (bbls.)
Government enterprises	5,485,415	5,900,120
Private enterprises	4,882,155	4,097,152
Total domestic	10,367,570	9,997,272
Imported crudes	3,544,805	3,961,378
Grand total	13,912,375	13,958,950

During 1930 a total of 132,804 bbls. of naphtha, 25,342 bbls. of kerosene, 10,895 bbls. of gas oil, and 148,604 bbls. of fuel oil were produced.

Selecting Tanker Propelling Machinery

Oil Companies Have Nine Accepted Forms of Power From Which to Make a Choice, Apart From Variations of the Individual Types.

By Robert W. Morrell

Consulting Engineer and Naval Architect
New York.

MARINE transportation of petroleum products in its relation to the petroleum industry, is a matter of interest to every executive in the oil business, not alone in the marine end, but to those concerned with production, refining and marketing as well. The problem is one of tank ships, their peculiarities, and the characteristics of this class of floating equipment which make it distinctive.

From the standpoint of the oil man, an oil tanker is simply a floating and mobile oil tank or group of tanks. The tank ship has to meet the same requirements as shore tanks, with respect to oil-tightness, ventilation, filling, emptying, cleaning, provision against evaporation, etc. The outstanding difference between a bulk oil tanker and a shore tank is mobility; its ability to move around, from place to place. And the feature of principal interest is then, logically—what makes it move?

We may eliminate from the present discussion any consideration of tank barges, towed by a tug boat or by another tanker. Tank barges form a study in themselves, with respect to size, shape, proportions and general design, as well as to the extent of their useful application in the problem of the marine transportation of oil.

Considering the subject of self-propelled tankers, we are immediately precipitated into the midst of the absorbing and much-debated problem of propelling machinery for tankers.

Upon first thought, it would appear that this is purely a marine problem governed solely by the broad principles of naval architecture and marine engineering, as in any other type of vessel. Generally speaking, this is true; but when one considers that, in selecting or designing the propelling machinery for an oil tanker, he is concerned with the propulsion, not merely of a ship but of a floating group of oil tanks, the picture takes on new aspects which bring home the intimate relations between the marine industry and the petroleum industry.

To be more specific, the peculiar features encountered in oil tankers which set them apart from other vessels with respect to their propulsion, are as follows:

1. Requirement of power, and machinery for heating and pumping the oil cargo.
2. Variable nature of the cargo with respect to gravity, expansion, etc., affecting the displacement and trim of the vessel.
3. Fire prevention and fire protection.
4. Customary requirement of extinguishing fires in ships' boilers when loading or discharging gasoline or other gaseous cargoes.
5. Relation between cargo oil and bunker fuel oil.
6. The well-known quick turn-around of tankers in port, made possible by the rapidity with which the liquid cargo can be loaded and discharged.

With these factors in mind, let us review the available types of propelling machinery from which to select:

(a) Reciprocating engines and Scotch boilers.
(b) Reciprocating engines and water-tube boilers.
(c) Geared turbines and Scotch boilers.
(d) Geared turbines and water-tube boilers.
(e) Turbo-electric and Scotch boilers.
(f) Turbo-electric and water-tube boilers.
(g) Direct-drive Diesel.
(h) Diesel-electric.
(i) Geared Diesel.

With respect to the Diesel items (g), (h) and (i), these could be further subdivided into two-cycle, four-cycle, single-acting, double-acting, opposed-piston, air injection and mechanical injection, with or without super-charging. These features, however, would add too much complication to the present discussion and serve only to confuse the issue. In the same way, reciprocating engines could be sub-divided into triple and quadruple expansion types; turbines into reaction and impulse types, direct or cross-compound; geared drive into single or double reduction; and boilers with or without superheaters, economizers, etc., and of high or low working pressures, ad infinitum.

The situation is further complicated by the necessity of considering the type of machinery for pumping the cargo in conjunction with the propelling machinery. Cargo pumps may be grouped under two principal headings, namely: steam-driven pumps either reciprocating-plunger type or rotary pumps driven by steam turbines or steam engines; and electrically driven pumps which are of the rotary type, driven by electric motors. A few instances have been noted of rotary pumps driven by internal-combustion engines (either gasoline or Diesel) but the difficulties in the way of this last arrangement are generally prohibitive as it is not good practice to locate an internal-combustion engine in the same compartment as the pump on account of the danger arising from the formation of an explosive mixture of petroleum vapor with air. In some cases, where the cargo-pump room is adjacent to the engine room, it has been found feasible to run the cargo pump by means of an internal-combustion engine having its driving shaft extended through a stuffing box in the bulkhead. The same gas hazard applies to the use of electric motors for driving cargo pumps as the danger from sparking at the motor brushes makes it undesirable to locate any motor in the cargo-pump room where it is subject to contact with a gassy mixture. This has been overcome in practice in two ways,—the first being by making the motors of a totally enclosed type with mechanical ventilation, and the second being to locate the motors in the engine room, if the latter is adjacent to the pump room, and driving the pumps by means of shafts extending through the bulkhead.

Another feature requiring consideration in conjunction with the propelling machinery is that of the donkey boiler. The typical tank steamer which has held sway for the last 30 years is equipped with a donkey boiler, apparently for the sole purpose of raising steam when the main boilers are cold. In ordinary operation it is necessary for a tank steamer to maintain one of the main boilers under steam in port for the purpose of heating or pumping the cargo and it is seldom

necessary or desirable to put out fires in all the main boilers at one time, except to comply with refinery regulations when handling gasoline or similar cargoes, or for the purpose of extensive overhauling and cleaning of the boilers. In this type of vessel the donkey boiler is not an important factor and a small vertical boiler would suffice in the great majority of cases for the occasional duty of raising steam. On Diesel-driven tankers, however—especially those carrying heavy oil—it is necessary to have steam in sufficient quantity to heat the living quarters and to heat the cargo. This results in the necessity of providing a larger donkey boiler for Diesel-driven tankers than is necessary for tank steamers. The use of waste heat boilers recently has been developed to the point where such equipment is a convenient adjunct on Diesel tankers as the exhaust from the auxiliary Diesel machinery will, in many cases, be sufficient to generate steam for moderate requirements of heating.

We now have a complete picture of the peculiar requirements of tankers with respect to propelling machinery, as well as an enumeration of the different types of machinery available to meet these requirements. The next step, therefore is to fit these togther in a manner which will result in the best solution of the tanker propulsion problem.

There are special conditions arising from a vessel being designed to operate exclusively in some special trade which will sometimes immediately provide a solution; the trade route or conditions may make it obvious that some special type of machinery is particularly desirable for that case to the elimination of all others. For instance, if a vessel were known to be required for the sole purpose of carrying heavy viscous oil and that she would never be required to carry anything else, it would be logical to equip her with steam machinery; on the contrary, if a vessel were intended to carry nothing but gasoline, it would be equally logical to provide some form of Diesel machinery. However, these are special cases which seldom arise. It is a well-known feature of tank ship operation that the activities of no tanker can be definitely confined to the carrying of only one kind of cargo throughout the life of the ship. The fluctuating nature of the business is almost sure to result sooner or later in a tanker being diverted to some other trade than that for which she was intended. Therefore, the great majority of tankers are—and should be—designed for general service, suitable for carrying all the different kinds of oil cargoes which the contingencies of the business may require and suitably equipped for handling products of all different characteristics.

We are faced with the problem of selecting machinery for a tanker suitable for general service; a vessel capable of handling heavy gravity oil requiring heating, yet with sufficient tank capacity and gas-production to carry and handle light, volatile cargoes.

Reciprocating Steam

LET us first consider the reciprocating steam engine as a prime mover. For many years this type of machinery held its own against geared turbines and Diesel engines, mainly because of low first cost and known reliability as compared with the more or less experimental development of the other types of propulsion.

With reciprocating engines, the economical speed of tankers was limited to 10½ or at most 11 knots on trial trip, as any increase in power to obtain greater speed encroached upon the cargo carrying capacity, with respect to weight and space required for machinery and fuel, to such an extent that the earnings were impaired. In other words, for higher speeds, the resulting reduction in cargo capacity more than offset the gain obtained through more frequent deliveries of cargo. War-time conditions also accentuated the predominance of the reciprocating machinery in past years. The adoption of geared turbine drive was seriously retarded by the unfortunate results obtained form various emergency installations of that type of drive.

Another factor which gave reciprocating engines the preference in tankers for so many years was the demand for quick turn-around. Granted that a triple or quadruple expansion engine requires considerable keying-up and maintenance in port, it was like an open book to all concerned. Everyone knew exactly what had to be done, how to do it and how long it would take. It was possible to have any necessary work done promptly and efficiently, while loading or discharging cargo, with the result that little or no delay was necessarily encountered for engine repairs and there was no interference with a schedule of quick turn-around.

On the other hand, during the period of development of Diesel machinery, the extent of voyage repairs required in port was often an unknown quantity. New parts were frequently required. It was impossible to make or maintain a schedule, or to count on a ship being ready for sea when finished with the cargo. In freighters, requiring a week or more at berth, this was not so apparent; but as tankers require only about 12 hours to load a full cargo, the importance of having the main engines ready, and not scattered upon the engine room floor, was vital.

Furthermore, with quick turn-around, if a new engineer was required (and the changes in personnel are apt to be more frequent with quick turn-around than otherwise), good engineers thoroughly familiar with reciprocating engines were obtainable on short notice, whereas it has been more difficult to find engineers with suitable Diesel experience.

The foregoing makes it readily apparent why steam reciprocating machinery found favor among tank ship owners and operators for a long period, up to very recent years.

In the present day the situation is different. The reliability and useful life of both turbine and Diesel machinery have been improved to a marked extent through better design, longer experience and greater familiarity. The low fuel consumption of the Diesel engine has made it an economic factor which compelled recognition, and this in turn has spurred designers and manufacturers of steam turbines and boilers to competitive efforts, mainly along the lines of higher pressure and superheat. The result has been the further development of propelling machinery, both turbine and Diesel, the fuel economy of which is vastly superior to reciprocating steam machinery, and which in addition has permitted an increase in the economical speed of tankers, beyond that which was attainable with quadruple expansion engines.

In this analysis, the reciprocating steam engine consequently is eliminated from consideration. Its sole remaining outstanding advantage is that of initial first cost; and that, to-day, is more than offset by better fuel economy and higher permissable vessel speed obtained with the other types of machinery. This statement does not necessarily apply to special patented equipment, such as the Bauer-Wach System, Lenz poppet-valve engines, etc., as sufficient data are not available to draw any sweeping conclusion. Such equipment would have to be considered as a special problem, on its own merits.

The same, in a large measure, is true of Scotch boilers. For many years this type predominated in tankers, largely because of their familiarity to the operators. Water-tube boilers have always been considered to require more delicate feed control and to be more susceptible to salting. The conservatism of tanker owners and operators has stood in the

way of the adoption of water tube boilers until recently. Competition and progress have demanded the adoption of the most efficient equipment. Increase in working pressure and total heat content have made the water-tube type a necessity for efficient steam installations. Through trial and experience, they have been found to work out successfully in service. In addition, the watertube boilers require less weight and space than Scotch boilers, and with respect to quick turn-around have the advantage of requiring less time for raising steam and for cleaning. The latter is an important factor in tanker operation, as the internal cleaning of Scotch boilers frequently holds the vessel in port. Improvements in condenser design have also re-acted favorably toward the water tube boiler. Scotch main boilers, therefore, are also eliminated from the present analysis.

The matter boils down to a selection of propelling machinery consisting of a steam turbine installation versus Diesel; the turbine proposition being subdivided into geared turbine and turbo-electric, and the Diesel proposition into direct-drive, Diesel electric, and geared Diesel.

For ready analysis, an outline of each proposition is given below, together with a summary of the relative advantages of the respective types.

Geared Turbines

FOR a single-screw tanker, machinery of this type would include water-tube main boilers having moderately high working pressure and superheat; an efficient arrangement of main steam turbines and double reduction gears; main condenser with air ejectors and condensate pumps suitable for sea and port use; steam driven cargo pumps, either of the reciprocating (plunger) type or the rotary type turbine-driven; a small vertical donkey boiler for raising steam; steam steering gear and windlass; desuperheater for the reduced pressure auxiliary steam line for deck machinery, various pumps, heating coils and smothering lines; and a complete steam smothering system for fire extinguishing and steaming tanks. Electric lighting sets and the engine-room auxiliaries would be turbine-driven.

Turbo-Electric

FOR this type, the machinery would include water-tube main boilers having moderately high working pressure and superheat; a combination of two, three or four main turbo-generators; main propelling motor; control panels; main condenser with air ejectors and condensate pumps suitable for sea and port use; cargo pumps of the steam plunger type, rotary type turbine-driven, or rotary type driven by enclosed ventilated motors (requiring one main turbo-generator unit to be run while discharging cargo); a small vertical donkey boiler for raising steam; steering gear and windlass either steam or electric, as desired; de-superheater for reduced pressure auxiliary steam line; and a complete steam smothering system for fire extinguishing and steaming tanks. The engine-room auxiliaries may be turbine-driven or motor-driven; whichever is preferred; a turbine-driven arrangement involves somewhat less first cost and complication. This is true of the cargo pumps as well.

Comparing the two steam turbine propositions, it appears that the fuel economy, space required and weight involved are very nearly equivalent for the two types of installation. The first cost of the geared turbine drive, however, is appreciably less than that of the turbo-electric, and the latter has no outstanding advantage, so far as general design is concerned to offset this differential.

Direct-Drive Diesel

THIS type of drive involves the following machinery and equipment: Direct reversing Diesel main engine with its attached compressor and pumps; two Diesel-driven generating sets to carry lights and motor-driven auxiliaries; auxiliary compressor, either motor-driven or Diesel-driven, preferably the latter; rotary type cargo pumps driven by enclosed and ventilated motors; a donkey boiler of sufficient capacity to heat the cargo and fuel, equipped for exhaust heating and for oil burning; necessary pumps and condensing system for steam plant; electrically-driven steering gear, windlass and engine room auxiliaries; air receivers of suitable capacity for starting and maneuvering and for injection of air if required; complete carbon dioxide or foam fire extinguishing system.

Diesel-Electric

INSTALLATION of this type requires a combination of two, three or four main-Diesel-driven generating sets with their attached compressors and pumps; an auxiliary Diesel engine driving an auxiliary generator for lights and an auxiliary compressor; main propelling motor; control panels; rotary cargo pumps driven by enclosed and ventilated motors; a donkey boiler of sufficient capacity to heat the cargo and fuel, equipped for exhaust heating and for oil burning; necessary pumps and condensing system for steam plant; electrically-driven steering gear, windlass and engine room auxiliaries; air receivers of suitable capacity (less than that required for direct drive); complete carbon dioxide or foam fire extinguishing system.

Comparing these two Diesel propositions, we find that the direct drive has the advantage with respect to first cost, also to a slight degree in fuel economy. On the other hand, the Diesel-electric drive involves less weight of machinery and less space required for the same, if moderately high piston speed is adopted for the main generating units. The higher the speed, the less is the first cost differential and the greater the saving in weight and space. It is purely a matter of individual judgment as to where to draw the line with respect to speed of Diesel engines. By the same token it is impossible to draw any fixed line of demarcation as to where the increased cargo capacity of a Diesel-electric tanker will be offset by the first cost and fuel economy. It is useless to generalize in such a problem, and the only solution lies in an actual calculation in dollars and cents for a particular case.

Geared Diesel

INSTALLATION for this type of drive is practically identical with the direct-drive Diesel, except for the introduction of single reduction gearing, with some slight loss in fuel economy and a reduction in weight and space due to the higher speed of the main engine, and some reduction in first cost. This combination appears to present very interesting possibilities, but its development has been limited in comparison with the other types of Diesel drive and it would be difficult to make a recommendation.

For the purpose of comparison of Diesel with steam drive, let us assume that the direct-drive Diesel and the Diesel-electric types are equally efficient with respect to over-all operating costs.

Comparing these Diesel types with the geared turbine drive, we find that the tank steamer has the advantage in first cost for equal power, and is better equipped for the heating of heavy cargoes. With respect to fuel consumption, expressed in barrels of oil, the Diesel has a decided advantage; as to cost of fuel, this depends upon the kind of fuel used. If Diesel fuel oil is the basis of comparison, the lower consumption of the Diesel is to a large extent nullified by the higher price of the oil; but, if the comparison is based on burning heavy fuel in the Diesel (as is done to some

extent), the advantage of the Diesel fuel economy remains practically intact. Here again is a matter for individual judgment. But regardless of the price of the oil, the quantity consumed in the Diesel is distinctly less than in the steamer; and the difference can be said to be additional cargo carrying capacity for the Diesel tanker; a decided advantage in earning capacity on long voyages and less so for short ones.

Rather than attempt to set down any hard and fast rule, it is the writer's opinion that a decision as to choice between Diesel and steam should be governed to some extent by the judgment of the prospective owner or operator as to the use of heavy fuel oil in Diesel engines, also as to the probability of the ship being engaged extensively in handling cargoes of heavy oil or operating on long trade routes, as well as other factors involving the particular service in view.

There is wide divergence of opinion among tank ship owners, as is evidenced by the fact that the principal oil companies have recently built tankers of the different types just discussed, which goes to show that each type has its particular niche in the economics of tanker operation. It is obvious that Diesel drive is more and more predominating the field of tanker propulsion. The quarterly report of Lloyd's Register of Shipping, dated October 14, 1931, shows the tonnage of Diesel tankers under construction to be 474,978 gross tons out of a total of 505,258 gross tons of tankers building of all types. This is 94 percent Diesel and clearly indicates the growth of this form of power.

Diesel-Electric Propulsion for Tankers

Will the Lead of the Atlantic Refining Company in Concentrating on This Form of Power for Large Tankships Be Followed by Other Oil Companies? Russians Initiated Use in 1904

ONE of Nobel's earliest tank barges, the SARMAT an 800 ton Volga river craft completed in 1904, utilized a form of Diesel-electric transmission; but there was a twenty year lapse before another oil company adopted this system of propulsion. This was the 1,560 tons d.w.c. coastwise tanker, J. H. SENIOR, owned by the Standard Oil Company of New Jersey. Several years later the Atlantic Refining Company commenced its extensive program of Diesel-electric tankships for ocean-going work, building some in the United States and others in Great Britain. Operating data on these vessels is not available as their owners have not released records; nevertheless it is not difficult to make a general case sufficiently appealing to demonstrate that electric drive for bulk oil carriers has merits worthy of close study by progressive oil interests that always are seeking maximum efficiency. Several further movements in the direction of Diesel-electric power have been made since by other American oil companies in the way of coastwise vessels of comparatively small tonnage on both the Pacific and Atlantic coasts. Just how far the oil industry will go towards its wider adoption is a matter to be determined by experience.

Under loaded conditions the propulsion of a tanker is closely akin to that of a cargo ship. Due to the United States Government three ships of 11,773 tons d.w.c. and 15,946 tons displacement were equipped several years ago with Diesel-electric power, and some valuable information on the matter of efficiency is available which also would apply to a tanker of similar tonnage and speed.

With these single-screw vessels the low propeller speed of 60 r.p.m. was adopted as producing the highest propulsive efficiency for a fairly full lined boat, and a 21½ feet diameter by 22¾ pitch wheel was installed. The power available at the shaft was 4,000 s.hp. Actually the Diesel-electric generators produced 4,850 b.hp., but the auxiliary machinery and the electrical losses represented the difference. The engines could have been designed to turn at 350 r.p.m. without losing any reliability and thus developed considerably more power on the same weight; but the Government engineers preferred to be conservative and have them rated at 250 r.p.m. Nevertheless a trial speed of 15¾ knots was obtained (or say 13 knots average service speed) on a fuel consumption of about 21 tons per day. This on a total machinery weight, including shafting, of 938 tons.

Compared with the direct drive Diesel installation there is a gain of nearly 20 percent in propulsive efficiency, more than offsetting the loss of approximately 10 percent in the electrical transmission, as direct drive would necessitate a propeller speed of 80 to 125 r.p.m. depending upon the particular type of Diesel, and whether single or twin screw.

As a matter of fact with direct drive the total power necessary to attain the same ship speed would be from 5,000 to 5,750 s.hp., assuming a similar loaded displacement, plus an equivalent to 750-1,000 horsepower in steam or Diesel for the auxiliaries. This extra power would go a long way to equalizing the higher cost of electric transmission, and, of course, would mean a higher fuel consumption. The reason for this is that with Diesel-electric drive, power for the auxiliaries is taken off one of the main engine-generator units both in port and at sea, assuming motor-driven rotary cargo pumps are adopted, using steam for heating black cargo when carried and utilizing combined waste exhaust heat and oil firing for the boiler.

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OIL men attending the A. P. I. annual convention at Chicago may be interested in knowing that the same week the International Acetylene Association will also hold its annual convention in Chicago.

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OUR cover picture this month illustrates a Union Oil Company fuel-oil barge bunkering the Danish Diesel motorliner EUROPA at Los Angeles, Cal., harbor. The frontispiece of this number shows the C. P. R. liner DUCHESS OF RICHMOND bunkering from the Imperial Oil Company river tanker Rideaulite.

Tanker Chartering Declines in 1931

Fundamental Soundness of Charter Market Likely to Be Overlooked Due to Decline During Past 18 Months. Black Sea Loading Demand Reflects Russian Export Activity.

LONDON, October 8.

TEMPORARY increase in tonnage demand at the moment that this article was closing for press reversed the general downward trend in tonnage demand which has been weakening the charter market for the past eighteen months. Demand, however, came largely from Black Sea ports with cargoes destined for U. K. ports, a short haul which is considerably less attractive to charterers than those which require two or three voyages.

This recent demand is credited to increased export activities of the Russian oil industry, and includes many features that have made charters from Soviet ports difficult and disagreeable contracts.

It is worth noting that the departure of Great Britain and other countries from the gold standard has had a somewhat restrictive effect on the freight market, charterers generally being disinclined to accede to owners' demands for payment on the gold currency basis. About the middle of September, immediately after Great Britain went off the gold standard, all chartering negotiations were very protracted, particularly for loading in the United States where the exchange had fallen considerably. Since the basic rate of 9/- Gulf was practically the lowest that any owner could accept, the depreciation in the American exchange made it impossible for owners to accept the Gulf basic rate mentioned on usual terms of payment. In the case of one ship, however, this difficulty was overcome by the charterers agreeing to the old basic rate of exchange, thus enabling the owner to accept 3/- from the Gulf.

These matters, of relatively recent occurrence, all go to emphasize the difficult situation which at present exists and has existed for some time in the tanker charter market. Apart from ordinary economic conditions, the situation is not likely to be improved by the gradual delivery of big programs of construction such as that which is now in hand for the Anglo-Saxon Petroleum Company. One charterer expressed the opinion very forcibly to a representative of WORLD PETROLEUM recently that the action of major oil companies in placing contracts for new tonnage was ill-advised because their work could be done for them by the excellent charter tonnage offering. Obviously, of course, there are two sides to this question. Even the Anglo-Saxon Company is not in any hurry to take delivery of its new ships, and in one or two shipbuilding centres in this country vessels in the 20-unit program, quite complete, may be seen laid up in the yard, awaiting delivery.

Terms "continue weak" and "few fixtures" alternate with "meagre enquiry" and "market remains depressed." The most serious section from the point of view of tramp oil tanker construction is the weakness of the time charter market. This weakness more than any other reacts directly on the shipbuilding and marine engineering industries of Europe. Unless the long-term charter market is firm it is impossible to expect that prospective owners will ever want to place new tonnage.

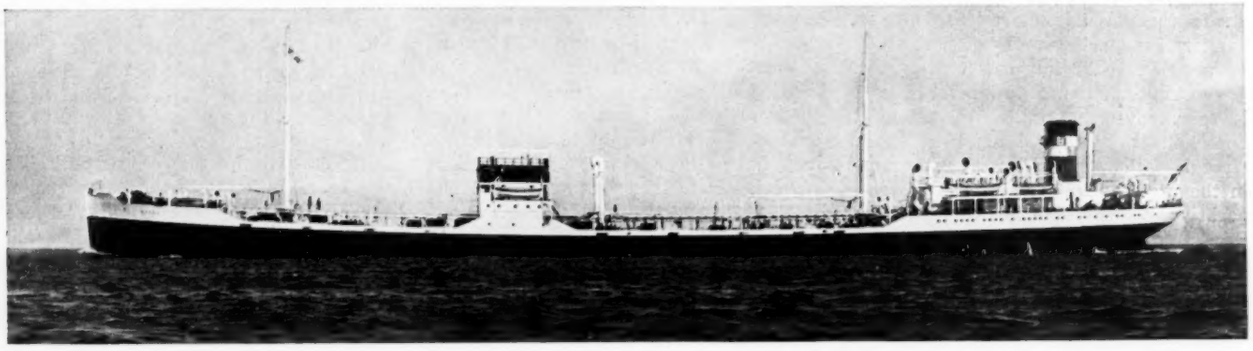
The only consoling thought in reviewing the charter market for the past year is that the whole business of oil transportation is essentially something with a big future. In spite of depressed conditions existing at the present time and a rather dark outlook for the immediate future, improvement in conditions will be reflected first in the tanker market because of the fundamental soundness of the business.

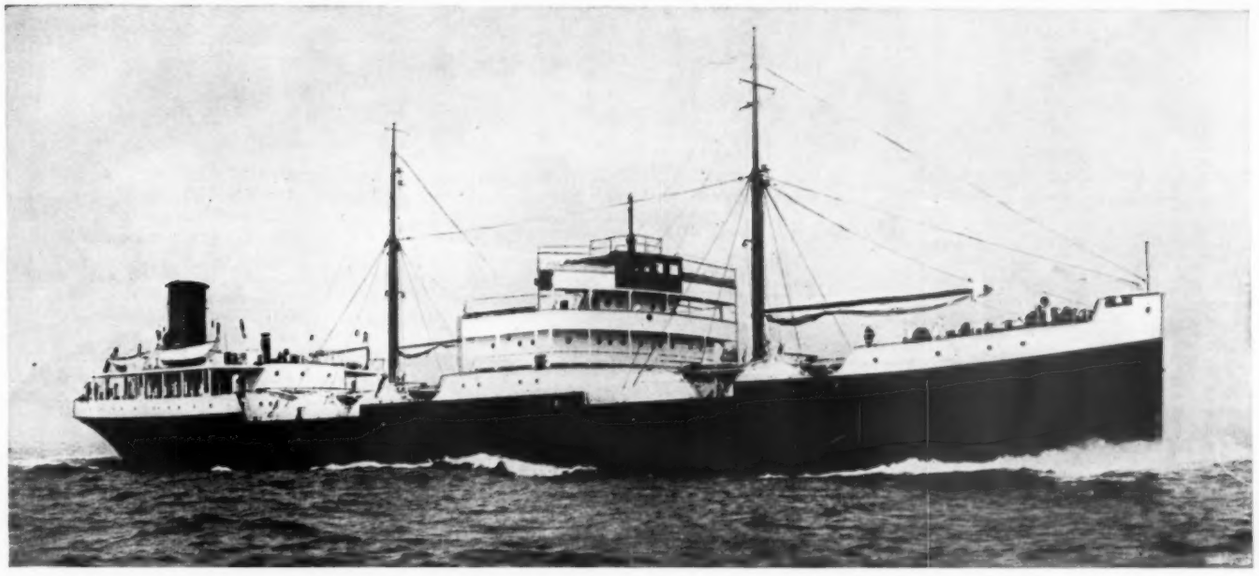
The statistics furnished in the accompanying table, covering the period from January 3 to June 30, 1931 were kindly made available for WORLD PETROLEUM through the courtesy of Davies and Newman, John I. Jacobs & Company, Ltd., and David C. Reid & Company.

January 3, 1931—

CLEAN OILS: Space for 600 tons, 10 per cent taken up in two large vessels, Gulf-U. K. Cont. at about 10/ basis.
BLACK OILS: Very few orders are quoting on this market. 6600 tons space carriage crude oil, Gulf-U. K. fixed 10/ per ton.
TIME CHARTER: Remains inactive.
AMERICAN COASTING: Continues very

Bonzo, a 12½ knot, 11,800 tons d.w.c. tanker built for Berg & Torgersen, Oslo, by the Monfalcone shipyard, Monfalcone, Italy. She is propelled by Diesel engines of 3500 s.hp.





Built to carry protane to put winter pep into motor fuel; its domed vertical, cylindrical tanks carry the cargo under pressure; the new motor tanker Agnita of the Anglo-Saxon Petroleum Company's fleet.

quiet. Dirty oil tonnage Gulf-Northern states recently accepted 14c for three voyages.

January 10, 1931—

CLEAN OILS: Demand for tonnage Gulf-Europe very scarce. Few inquiries for tonnage emanated Black Sea-U. K. Cont. Large vessel San Pedro-Buenos Aires fixed 60c.
BLACK OILS: Market has been very quiet. 8500 tonner fixed Black Sea-Cont. carriage lube or gasoil two cons. voyages 10/- Large Norwegian tanker fixed part cargo 7000 tons whale oil Antarctic-Europe 30/-.
TIME CHARTER: Bare of enquiry.
AMERICAN COASTING: No change to report.

January 17, 1931—

CLEAN OILS: Demand slightly in excess of previous week. Large tonnage available Gulf-U. K. Cont. 9/6d or Constanza 8/- full cargoes. Part cargoes of about 4/5000 tons owners are asking 10/- from Constanza.
BLACK OILS: Market continues very quiet. Large vessel fixed carriage crude oil Tampico-U. K. Cont. 9/3d. Handy vessel 4500 tons fixed 8 cons. voyages Black Sea-Fr. Atlantic ports carriage gasoil and/or lub. oil 14/-.
TIME CHARTER: Absence of enquiry for tonnage on this basis.
AMERICAN COASTING: Remains unchanged.

January 24, 1931—

CLEAN OILS: Absence of demand Gulf-Europe. Large vessel fixed for carriage 7700 tons max. Black Sea-Fr. Atlantic 8/- 7700 tonner, fixed carriage whale oil Antarctic-Europe at about 31/6d.
BLACK OILS: Enquiry remains scarce. 7500 tonner Black Sea-U. K. Cont. 10 cons. Voyages 9/6d for first five and 10/6d for last five voyages.
TIME CHARTER: Remains bare of enquiry.
AMERICAN COASTING: Nothing new to report.

January 31, 1931—

CLEAN OILS: Part cargo 6,000 tons placed Trinidad—U. K. 9/- A parcel of about 6,000 tons fixed Constanza—2 ports East Coast U. K. 8/- 7500 tonner, Palembang-U. K. Cont. 19/-
BLACK OILS: Very few orders are quoting. Dark oil vessel fixed carriage 6000 tons vegetable oil Black Sea-U. K.. Cont. 11/6d.
TIME CHARTER: Absence of enquiry for tonnage on this basis.
AMERICAN COASTING: Market remains quiet. Last reported fixtures crude oil tonnage Gulf or Venezuela-Northern States 15c with option Tampico loading 17c two trips.

February 7, 1931—

CLEAN OILS: Little demand for tonnage from Black Sea. Large vessel fixed Constanza-2 ports Fr. Atlantic 8/- Parcel 6000 tons benzole placed Gulf-U. K. 10/- 9500 tonner California-Shanghai 32c per bbl.
BLACK OILS: Market remains very quiet. 6500 tonner reported fixed Black Sea Fr. Atlantic carriage gasoil 11/-
TIME CHARTER: Still bare of enquiry 8700 tonner fixed continuation 12 mths. 4/9d on deadweight-dirty oil trading.
AMERICAN COASTING: No change to report.

February 14, 1931—

CLEAN OILS: Very little business transacted on this market. 7500 tonner Constanza-Fr. Atlantic 8/-
BLACK OILS: 13000 tonner fixed with 10,000 tons crude oil Venezuela-Ostermoor 7/6d., completing at Tampico at 8/6d. per ton. 6500 tonner Venezuela-U. K. 10/- carriage crude oil.
TIME CHARTER: Still an absence of enquiry for tonnage on this basis.
AMERICAN COASTING: Remains unchanged.

February 21, 1931—

CLEAN OILS: Two large vessels fixed Russian Black Sea-U. K. Cont. 7/6d., which is the lowest rate so far accepted. 7500 tonner with 6000 tons of space taken Constanza-Fr. Atlantic 7/6d. 7500 tonner Gulf-U. K. Cont. 9/6.
BLACK OILS: Market extremely quiet. Vessel recently chartered for carriage 8/12,000 tons fuel oil Trinidad or Curacao-Anarctic at lump sum freight of £12,000.
TIME CHARTER: Remains unchanged, although charterers are open for a M. V. 9/10,000 tons dw. for 5/6/7/8 months dark oil.
AMERICAN COASTING: Nothing new to report on this market.

February 28, 1931—

CLEAN OILS: An absence of demand for tonnage Gulf-Europe. 7500 tonner Constanza-Cont. 7/-. Vessel similar size Black-Sea-Vladivostok 17/6d.
BLACK OILS: One or two orders quoting on market, no fixtures, however have been reported during the week.
TIME CHARTER: Steamer 7500 tons dw. fixed six mths. 3/9d. M. vessel 9500 tons dw. placed for six mths at £2400 per mth., owners paying extra insurance for Canadian trading.
AMERICAN COASTING: Remains unchanged.

March 7, 1931—

CLEAN OIL: Fixtures concluded Black Sea-U. K. Cont. Large vessel part cargo 7000 tons Constanza-U. K. Cont. 7/3d. Part cargo similar size Constanza-Antwerp and Humber 7/6d. 9000 tonner Russian Black Sea-U. K. Cont. 7/6d.
BLACK OILS: Demand for tonnage very poor.
TIME CHARTER: Absence of enquiry for tonnage on this basis.
AMERICAN COASTING: Market remains extremely quiet.

March 14, 1931—

CLEAN OILS: Still an absence of demand for tonnage Gulf-Europe. 9500 tonner Black Sea-U. K. Cont. 7/- Orders quoting carriage clean oils North. States-South Africa, tonnage obtainable 15/-. Also Black Sea-Vladivostok, but business has so far not resulted.
BLACK OILS: Market remains dull. 9000 tonner fixed carriage crude oil Aruba-Teneriffe 6/-. Enquiry quoting carriage 4500/5000 tons black lub. oil Gulf-France, but tonnage so far not obtainable for this business, rates being unacceptable. An order large tanker fuel and/or Diesel oil Batum-Leningrad 10/-
TIME CHARTER: Still an absence of inquiry.
AMERICAN COASTING: Remains unchanged.

March 21, 1931—

CLEAN OILS: Gulf-Transatlantic market still bare of enquiry. 8500 tonner Black Sea-Vladivostok 16/9d. 7500 tonner California-Shanghai 34c per bbl.
BLACK OILS: Demand for tonnage continues poor. One or two enquiries Gulf ports-Europe at unattractive rates.
TIME CHARTER: Steamer 10,000 dw. accepted 3/9d. for 6 mths., dark oils, American coasting.
AMERICAN COASTING: Remains very quiet. Gulf-North. States tonnage recently accepted 14c per bbl., carriage fuel oil, 18c having been paid clean tanker.

March 28, 1931—

CLEAN OILS: Demand practically confined to Black Sea loading. Two vessels 7500 tons fixed Russian Black Sea-U. K. Cont. 7/. Large vessel Constanza-U. K. Cont. 6/9d part cargo 7000 tons. 10,000 tonner Russian Black Sea-U. K. Cont., Bordeaux/Hamburg 7/-.
BLACK OILS: Several enquiries quoting recently. 4500 tonner fixed carriage lub. oil, and a part cargo of 5000 tons has been taken Gulf-Fr. Atlantic ports.
TIME CHARTER: Remains devoid of enquiry.
AMERICAN COASTING: Nothing new to report.

April 11, 1931—

CLEAN OILS: 7500 tonner fixed Russian Black Sea-U. K. Cont. 7/-. 9500 tonner Contanza-U. K. Cont. 7/-. Carriage 4000 tons space Constanza-Antwerp 7/9d. 8500 tons max. cargo placed at lump sum freight £6000. B. S. to Durban Gulf-Europe market bare of enquiry.
BLACK OILS: Market remains dull with very few orders quoting. 9000 tonner with crude oil Aruba-Dakar 7/. About 4000 tons fuel oil space fixed Trinidad-U. K. Cont. 10/6d.
TIME CHARTER: No demand for tonnage on this basis.
AMERICAN COASTING: Continues very quiet. Dark oil tonange Gulf-North. States 15c.

April 18, 1931—

CLEAN OILS: Market has been very quiet. 9000 tonner fixed Black Sea-Vladivostok 16/9d. Tonnage Black-Sea-U. K. Cont. obtainable 7/- but business so far failed to mature.
BLACK OILS: Large crude oil carrier Aruba-Teneriffe 6/-. Constanza-Ceuta 7600 tonner 6/- carriage of gasoil and/or fuel oil.
TIME CHARTER: An absence of demand for tonnage on this basis.
AMERICAN COASTING: Remains unchanged.

April 25, 1931—

CLEAN OILS: Demand for tonnage restricted. 4000 tonner Russian Black Sea-two Fr. Medit. ports 9/6d. An enquiry for large tonnage California-U. K. Cont. has been quoting, but business so far failed to materialize.
BLACK OILS: Several enquiries quoting with very little business resulting. 4000 tons space carriage lub. oil Gulf-U. K. Cont. fixed 14/.
TIME CHARTER: 9000 tonner placed for 4/5/6 mths. for dark oil Amer. coasting, including Canada 3/7½d per dw. ton. Otherwise market remains unchanged.
AMERICAN COASTING: Remains very quiet. Dark oil tonnage 14c Gulf-North. States.

May 2, 1931—

CLEAN OILS: Enquiries principally have been from Black Sea and for parcels ranging 1000 to 4000 tons. Large vessel fixed Russian Black Sea ports-U. K. Cont. 7/-
BLACK OILS: Several enquiries for large tankers. 12,500 tonner Aruba-Teneriffe with crude oil 5/9d. Vessels Java-North States with molasses at $4.34.
TIME CHARTER: One or two enquiries but these have been of a more or less indefinite character.
AMERICAN COASTING: No change to report.

May 9, 1931—

CLEAN OILS: Orders have been quoting from Black Sea also Trinidad-U. K. Cont. but rates indicated have failed to interest owners. 8000 tonner fixed California-Fr. Atlantic 11/6d. and a boat similar size Gulf Rio and Santos 10/-
BLACK OILS: Further enquiry for dark oil boats. 7500 tonner placed carriage gas and/or fuel oil Russian Black Sea-Belgium at 7/3d. American tanker loading dark oils California-Japan accepted 40c basis one discharging port.
TIME CHARTER: Very little demand exists.
AMERICAN COASTING: Remains very quiet Dark oil tonnage from Gulf-North States 15c.

May 16, 1931—

CLEAN OILS: 7500 tonner Gulf-U. K. Cont. 9/- 7500/8000 tonner Russian Black Sea-U. K. Cont. 7/-. 5500 tonner Constanza-Fr. Atlantic 8/6.
BLACK OILS: One or two enquiries for dark oil tonage Black Sea and Gulf-U. K. Cont.
TIME CHARTER: Continues devoid of enquiry.
AMERICAN COASTING: No change to report.

May 23, 1931—

CLEAN OILS: Large vessel recently placed Gulf and Trinidad-U. K. Cont. Gulf loading being 4000 tons 9/- and 2000 tons at 10/6d. Balance loading Trinidad about 6000 tons 6/9d.
BLACK OILS: Large vessel required carriage Gas/Fuel/Lub. oils for 1/2/3 voyages Black Sea-Leningrad 8/6d. Small tonnage also wanted 3000 tons gasoil, Constanza-Belgium. 4500 tonner fixed Northern States-Hamburg 11/- 6500 ton tanker fixed California-Japan 40c per bbl.
TIME CHARTER: Some inquiry but little of definite nature. Large tanker required for 4 mths. 3/6d on deadweight.
AMERICAN COASTING: Devoid of enquiry.

May 30, 1931—

CLEAN OILS: Two 7500 tonners fixed Russian Black Sea-Fr. Atlantic 7/- option loading 6000 tons 10% more or less at 8/ 7500 tonner Palembang-Mediterranean 15/- basis. 12,000 tonner wanted Russian Black Sea-Vladivostok loading 9000 tons clean oils and balance of about 2500 tons dark oils. Large tonnage also required Black Sea to Fr. Atlantic
BLACK OIL: Enquiry maintained. 7500 tonner with dark oils placed for one option two further voyages Russian Black Sea-Leningrad 9/- first voy. 9/9d second voy. and 10/- third voy. Parcel 3000 tons gasoil closed Constanza-Belgium 8/6d. 4500/5000 tonner gas and or fuel oil, Batoum-Rouen 9/-. Part cargo Paraguana-U. K. 6/6500 tons crude oil, 9/9d. 10,000 tonner California-U. K. fuel oil, two voyages, 12/6d. 7500 tonner dark oil, Cartagena-Antwerp 7/6d.
TIME CHARTER: Large dark oil boat wanted 6 mths. 3/3d dw. ton per mth. for steamer, Russian account. 11,000 dw. motor tanker fixed at 4/6d on the dw. for 3/4/5 mths.
AMERICAN COASTING: Remains quiet. During the month three dark oil tankers placed Gulf-North States 15c.

June 5, 1931—

CLEAN OILS: Enquiries from previous week transatlantic tonnage withdrawn. 9100 tonner, fixed Constanza-Havre & Rouen 7/8d and London & Hamburg 7/9d. 12,000 tonner clean and black oils, Black Sea-Vladivostok and/or Amur Bay 16/9d.
BLACK OILS: 12,000 tonner fixed Gulf-U. K. Cont. 8/- 8500 tonner Gulf-Cont. 9/-
TIME CHARTER: Enquiries for coiled ship for 6 mths. prompt delivery U. K. Steam tonnage offering at 3/7½d. and motor vessels at 4/9d.
AMERICAN COASTING: Remains unchanged.

June 12, 1931—

CLEAN OILS: Improvement in enquiries for black oil tonnage becoming noticeable in clean oils including 5/8000 tons Gulf-Fr. Atlantic and 6000 tons handy vessel Gulf-U. K. Vont. 6100 tonner Constanza-Arzew and/or Port de Bouc 6/6d. 4000 tons part cargo Constanza-Rouen 7/6d. 7000 tons max. part cargo Black Sea-Baltic 9/6d.
BLACK OILS: Enquiries include any size up to 12,000 tonner Gulf-U. K. Cont. 8/9d and 7500 tons max. Gulf-Fr. Atlantic 2 cons. voyages 9/-.
TIME CHARTER: Further tonnage closed 3/4 mths. B. N. A. 3/7½d.
AMERICAN COASTING: Remains quiet.

June 19, 1931—

CLEAN OILS: Demand again falling off with expectation of greater stability in the near future. 9000 tons fixed Gulf-U. K. Cont. 9/- 7500 tons Constanza-U. K. Cont. 6/9d. 7000 tons Russian Black Sea-U. K. Cont. 7/-.
BLACK OILS: Enquiry Gulf-Fr. Atlantic 9/- any size up to 9000 tons. 13,000 tonner fixed Gulf-U. K. 9/-. 9000 tonner Gulf-Fr. Atlantic 9/-.
TIME CHARTER: Two enquiries for 12 mths. transatlantic 3/9d and Pacific trading 4/9 black oils.
AMERICAN COASTING: Remains quiet.

June 26, 1931—

CLEAN OILS: 7500 tonner fixed Gulf-Fr. Atlantic 9/-. 6500 tonner northern states-Antwerp and/or Hamburg 7/6d. 9000 tonner Black Sea-U. K. Cont. 7/-. 6100 tonner Constanza-U. K. 8/3d.
BLACK OILS: Very quiet pending indication French refiners requirements.
TIME CHARTER: No further enquiry.
AMERICAN COASTING: Quiet.

Separating and Mixing Problems

Conclusion of the Treatise On Certain Refining Problems by Horace M. Weir, Chemical Engineer of the Atlantic Refining Company. Previous Installments in August, September and October.

VARIOUS types of mist removing baffles have been proposed and some discussion of their efficiency in terms of reduced percentages of entrained liquid weight on the basis of total vapor weight has been given.[1]

It has been shown recently that the effectiveness of an acid treating procedure in reducing the color of any given stock is a logarithmic function of the percentage of the original color which must be removed to obtain the desired final color.[2] This terminology is based upon a system of measuring colors on the assumption that they may be expressed as a concentration of colored material in colorless diluent oil—an assumption which accords surprisingly with the facts when proper determinations are made. Due to this relationship between the quantity of sulfuric acid necessary for treatment and the percentage removal of color it is apparent that contamination of distillates with highly colored undistilled residue may require very large additional quantities of acid for treatment. As a matter of fact the color concentration of residues from typical mid-continent crude may be from 30 to 60 times that of the uncontaminated heavy distillate fraction. The heavy oil distillate taken from many, and indeed most, crude oil fractionating columns bears little resemblance to the quality of these same distillates if the fractional percentage of entrained unvapored material had been properly removed. Assay distillations are quite incapable of showing the percentage of entrainment which exists in most operations but the amount of acid required subsequently to remove this entrainment may be as high as from 3 to 10 times as much as would otherwise be necessary.

The existing patent situation does not allow any more explicit discussion other than a statement that close attention to the problem of mist extraction from vapors in fractionating columns will amply repay the time and effort expended.

Another type of problem concerned with the removal of mist from gases is presented by the operation of plants making or recovering sulfuric acid for petroleum treatment. Residue gases from such plants nearly always contain sufficient amounts of sulfuric acid in droplet form to warrant, if not to compel, removal on account of nuisance to the community.

The use of electrical precipitators employing corona discharge has come to be recognized as a most effective means of dealing with this problem. The mist bearing gas is passed between two electrodes charged so that a difference of potention of from 20,000 to 100,000 volts exists. A lead pipe connected to the earth is frequently used as the "collecting" electrode. The discharge electrode is centered in the pipe and may consist of wires, chains, strips with serrated edges or any other form of conductor which will establish a high potential gradient at or near the surface. This electrode is generally charged negatively with respect to the collector and to the ground. Until rather recently the necessary high tension undirectional current has been obtained exclusively by transformation of alternating currents obtained at plant voltages followed by rectification with synchronous motor driven commutators. Within the last two years the commutator rectifier has been superseded by static copper oxide rectifiers in numerous places. Eleven plants of this type are stated to be giving excellent service in England.[3] When the voltage of such a system is raised above the critical point a corona discharge is established between the electrodes with attendant ionization of the gas passing through the pipe. Solid or liquid particles carried with the gas pick up the gas ions, thus becoming charged, after which they are attracted to the electrodes. Relatively little of the material finds its way to the discharge electrode and the "collector" electrode (pipe wall) usually precipitates about 95 percent of the liquid.

The efficiency of these electrical precipitators' operation on acid mists presumably follows the same type of equation as that which has been given and substantiated for the removal of various kinds of solid particles. The equation is:

$$1-E=CtK$$

Where E = treater efficiency
t = time of treatment.
C = type of treater.
K = a constant expressing characteristics of the gas.

The power costs of electrical precipitation are stated to be between that equivalent to ½ to 1 kilowatt hour power consumption per 100,000 cu. ft. of gas treated.[4]

Mixing Equipment

WHEN two miscible liquids are to be mixed the chief feature of the plant problem is proper proportioning of the materials. On the other hand, when a reaction between two partly miscible liquids is desired the advisability or necessity of keeping up intimate contact after proportioning generally presents the more difficult phase of the problem.

Equipment to proportion the streams of liquid may consist of separate piston pumps linked together to the source of power or a turbine pump arrangement in which the volume of flow of one fluid furnishes the power for pumping the other. Such devices can be easily controlled inasmuch as the criteria of their efficiency is had from gauges on materials involved.

Proper contracting of two partly miscible fluids to effect some physical or chemical reaction presents a more difficult problem. In most cases the refiner wishes to accomplish some effect which is only imperfectly understood so that the criteria of efficiency of mixing is more or less intangible. Good illustrations of this situation are furnished by processes for removing sulphur compounds from naptha or oil by washing with special caustic or other chemical

[1] R. B. Chillas and H. M. Weir, Jour. Ind. & Eng. Chem., Vol. 22, p. 206, 1930.
[2] H. M. Weir, W. F. Houghton, F. M. Majewski, Jour. Ind. & Eng. Chem., Vol. 22, p. 1293, 1930.
[3] Note—V. F. Gloag and J. P. V. Wollam—Fuel, Vol. X, p. 137, 1931.
[4] W. A. Smith—Transaction American Institute Chemical Engineers, Vol. 21, page 11, 1928.

solutions or by the acid treating process as applied to low or high viscosity stocks.

While in both of the cases the goal is to obtain a certain type of end product the mechanism of removal of the undesirable constituents from the charged oil is obscure. In general this means that a standard of 100 percent efficiency in the use of the reagent can not be set up. Furthermore, what with the changing quality of charge stocks which the refiner must handle this (unknown) 100 percent efficiency alters from time to time.

The situation is an ideal one for speculation, for the introduction of as many forms of mixing equipment in refinery processes as the leisure and inventive ability of interested parties allow. The problem of determining the relative efficiency of various mixing devices is generally difficult under refinery conditions while the absolute efficiency is practically impossible to measure.

Certain more or less obvious observations are sometimes helpful in determining the type of mixing equipment suitable for a given problem.

Orifice mixers, ejectors or jet type mixers and static blade or what may be termed labyrinth mixers have the advantage of low investment and repair cost coupled with reliability in the sense that they continue to perform their function even though little or no attention is given them.

These advantages are frequently stressed as satisfying the important factors in the problem of efficient mixing of reagents. That this is far from the case is apparent when it is realized that the value of the materials handled annually by almost all mixing units is many thousands of times that of the cost of the mixer itself. Very small percentage savings in chemicals throw the economic balance in favor of the particular equipment which can effect them almost irrespective of first cost or even of labor costs in attendance.

This fact opens the way for power driven mixing units which are practically independent of conditions of fluid flow up to the point where the mixer is installed. While units of this type are almost invariably more expensive in first cost than the static form of mixing devices the power cost for well designed paddle or turbine mixers is generally less than that which is involved in pumping fluids against the head required for equally efficient action of static mixing devices.

As before, however, power costs are in all practical cases insignificant in respect to possible savings in chemicals. The principal advantage of paddle or turbine mixers is their flexibility obtainable through the ability to regulate both the degree and the time of agitation. Unfortunately, the static forms of mixing equipment do not offer any effective control on either of these variables which are of prime importance for many processes.

The dynamics of fluid flow in commercial mixers defy definition in terms which are really illuminating with regard to how effectively such mixers may promote a given reaction. While paddle or turbine mixers are no exception to this statement they do possess the advantage that the degree of mixing under otherwise constant conditions is strictly proportional to the average time in which the material remains in the equipment. The alert operator of these devices is thus provided with means to build a background of valuable empirical data which, properly interpreted, will ultimately result in process savings. In most cases it is not necessary to sacrifice immediate efficiency to secure this future advantage, a fact which should weigh heavily as a factor in final decision as to the type of mixing equipment to be installed.

In concluding this article it may be asserted that the last decade in the petroleum world has witnessed the gradual replacement of methods which were a curious mixture of sound common sense and irrevalent ritual. While it can hardly be maintained that none of the latter exists in present day refining procedure, the attitude of the industry has definitely changed, so that it is not idle to expect that the next decade will see the refiner attacking all his problems, from the standpoint of first principles untinctured by such elements of mystery as still persist.

(CONCLUSION)

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British Firms Combine Marketing

LONDON.

By relinquishing the gold standard, Great Britain has upset the economic balance in many of her industries for the time being, and has in addition altered the fortunes of many industrial and trading companies, especially those whose operations are international. In the oil distributing industry, the balance of power may for the moment be maintained by the close co-operation which the leading companies announced at the end of September, a few days after Britain had been forced off the gold standard.

One of the first considerations of the companies was the avoidance of any considerable increase in the price of petrol; a second important consideration was that particular attention should be devoted to reducing distribution costs and eliminating unnecessary competition. With trade already depressed, and higher petrol taxes imposed in the Supplementary Budget, many men in the industry feel that the mere possibility of a rise in petrol prices to correspond to the decline in the value of Sterling would cause many British motorists to lay up their cars altogether in a panic for personal economy.

If the arrangements contemplated by the companies mean anything at all, they imply a tightening of previous arrangements as to price fixing, and a slackening of direct rivalry. As importers into a country with a depreciated currency, the great majority of oil concerns distributing in Great Britain apparently will be losers by the relinquishment of the gold standard. The only development which could eliminate the loss of profit would be a rise in internal selling prices, the natural corollary of currency depreciation—and this the distributors have apparently set their faces against.

Anglo-American provides the most obvious example of how loss of earning power will occur. As the marketing unit for the Standard Oil Company (New Jersey), this undertaking buys its oil on a dollar basis, and sells it in terms of depreciated sterling. The fact that its capital is also in sterling will make no difference to the controlling group, since Anglo-American earnings expressed in United States currency, will on the basis of the recent exchange rate equal 80 cents for every dollar they brought in formerly. It is difficult to imagine economies in distribution in the British market making up the difference.

Very similar conditions apply to the Shell distributing organization, which gets its supplies, and, therefore, pays production costs, largely in countries still nominally on a gold basis. In this case, however, the sources of supply are so varied, and the ramifications of the Royal Dutch-Shell group so diverse, that a definite loss through the depreciation of Sterling is less easy to trace. The company, too, has a Sterling capital, which should minimize any profit decline as far as its own shareholders are concerned.

Anglo-Persian appears to be in a slightly better position than either of the two foregoing undertakings. It ships a large proportion of products in the form of crude, and refines in Britain. Although the source of production is Persia, a large part of the company's costs, such as salaries, plant renewals, etc., are paid for in Sterling.

As usual, the position of Russian Oil Products, the Soviet distributing concern in Great Britain, is the most obscure. The company, in accordance with its previously existing arrangements, is maintaining its fixed price differential below the selling prices of the "combine" undertakings. But owing to the nationalized oil properties operated, and the doubtful terms of outgoings for labor, it is difficult to assess the production costs for the Russian oil industry. The British company buys from the Russian end, and states that it has done very badly with its contracts owing to Sterling's decline. Like the Anglo- American and the Shell marketing companies it is only part of a big concern, and unsatisfactory conditions in Britain only mean a decrease in profit earning capacity in one market in which the controlling concern operates. Probably the Russians are more dependent on this market than other controllers of British distributing companies, and it is reported that the decline in Soviet oil net receipts from Britain are already causing the Soviet authorities some financial embarrassment.

Among other distributors in the British market, Trinidad Leaseholds is probably as favorably placed as any. This company, with a Sterling capital, draws its supplies from a Colony with British currency, has its own distributing organization in Great Britain.

Standard Oil of Indiana, operating through Petroleum Storage and Distributing Company, may feel the fall of Sterling particularly, since it has been undercutting the major group. But here again, the British market cannot mean very much to the controlling concern in comparison with its total operation.

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Practical Application of Stabilization

(Continued from Page 609)

tion oil producers were strongly encouraged to unite on a definite plan of conservation. Yet, when it appeared that the principal producing interests were virtually on the point of accepting such a plan, the Federal authorities declined to give the movement their support or to extend any assurance that its adoption would not be followed by an attack from the legal representatives of the government. Under these circumstances little progress has been possible in the direction of a general agreement among oil producers of the nation at large and workers in the cause of stabilization have been compelled perforce to place greater dependence upon action by the individual states.

The fundamental weakness in state efforts toward stabilization is of course that all the good resulting from the adoption of an efficient plan of cooperation in one state may be nullified by lack of regulation in some other large producing section. This danger has been strikingly exemplified during the current year by the effect upon crude oil prices of rapid expansion in the new East Texas field. Indirectly, however, the decline of prices to utterly unprofitable levels has led to the production of another weapon from the armory of the State Governments in the form of declarations of martial law by the Governors of Oklahoma and Texas, temporarily shutting down production in flush fields. In the latter state the action of the Government undoubtedly helped to win the tardy approval of a dilatory legislature for a law broadening the power of the state commission to deal with overproduction.

The ineffectiveness of uncoordinated action by individual states in accomplishing the needed improvement in the relationship between production and consumption has long been evident. The natural way, indeed the only way, of meeting this difficulty has been clear to those who have been active in plans for stabilization. During the past two years many suggestions for an understanding among state conservation commissioners upon a comprehensive plan of control have been proposed and a definite plan of prorated production for the larger fields of the country was put forward by the special committee appointed at the meeting of state commissioners held in Oklahoma City on September 11. Should this suggestion prove acceptable to the various State bodies there is nothing to prevent the carrying through of the plan proposed which would provide in effect a national system of regulated production. The committee in fact has gone beyond this and proposes that a world conference of oil interests be assembled to make stabilization an international rather than a national undertaking. This is a proposal that has been advocated consistently by WORLD PETROLEUM. Once harmony of action becomes a fact in the United States there is no reason why a world agreement should not follow. While the method of dealing with the subject through state action may seem unduly cumbersome to members of the industry in countries not committed to legislation designed to enforce unlimited competition there appears to be a possibility at least of the attainment of a satisfactory result.

Obviously the crux of the problem of national stabilization through state cooperation rests upon the ability of state authorities to establish and maintain an equitable and harmonious working policy. While there are possibilities of difficulties in this direction there are reasons also for expecting such difficulties to be avoided or overcome.

Since most of the powers that need to be employed in an effective plan of conservation belong properly to the states; since state representatives have a very direct interest in the prosperity of producers in their territories, and since the states already have gone a long way toward laying the groundwork for cooperative action, this may prove the easiest and most effective way of arriving at a workable plan. It is purely a pragmatic problem in which practice rather than theory must be the test of success and from this point of view further efforts in the direction of state cooperation appear desirable.

The Foreign Oil Legion

Dr. A. E. DUNSTAN, chief chemist of the Anglo-Persian Oil Company, has returned to Persia from leave in England.

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A. F. DABELL, general manager in Trinidad of British Controlled Oilfields and of the Trinidad Petroleum Development Company, a controlled undertaking, was in England recently on leave.

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Pierre VIENNOT, a well-known French geologist who was sent by the French Government to explore the Iraq oilfields, with Mr. de Boeck, has passed away. Mr. Viennot was responsible for drilling work in the Gabian field in France, where a certain quantity of oil was obtained.

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A. O. HUNTER, manager of the Shell Company of Rhodesia, is in England on four months' leave. He is being relieved by P. MacMillan, manager of the Johnannesburg branch.

▼

Dr. G. M. LEES, of the Anglo-Persian Oil Company, is in Persia on a tour of inspection.

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William BOLTON, purchasing agent of Astra Romana, has returned to England on leave.

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H. L. ROBINSON, who early this year accompanied J. J. Brown, chairman of the Foster Wheeler Corporation, on an extensive business trip through Europe, has been appointed general sales manager of the company. Mr. Robinson's wide knowledge of refining conditions in other countries will be a valuable asset in his new duties.

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J. JANZEN, South American representative of Ingersoll-Rand Company, has returned to the United States for a visit of several months following two and one-half years in Venezuela, Columbia and Trinidad.

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A. W. ROGERS has been appointed a director of Trinidad Leaseholds in place of Sir A. E. Wallers, who has resigned.

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R. R. WIGGANS, in charge of engineering for the Lago Petroleum corporation in Maracaibo Lake basin of Venezuela, has returned from abroad via New York. He spent his entire leave visiting the various countries in Europe, devoting most of his time to Italy.

H. L. Robinson, Foster Wheeler Company

J. B. HUNTER, assistant general manager in India of Burmah Oil Company, is in London on leave, after making a tour of America and Asia.

H. B. SHIRLEY, field superintendent of the Trinidad Leaseholds, Ltd., is spending his vacation in the United States.

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Samuel HASKELL, representative of The Texas Company at Bogota, Colombia, has returned to the New York headquarters of the company.

▼

J. MCADAM, W. A. Franklin, A. H. Tait and N. L. Falcon, of the Anglo-Persian geological staff, have returned to Persia from leave.

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Robert F. HAND, vice-president of the Standard Shipping Company, has returned to the United States following a business trip to Italy, Switzerland, France and England. Mr. Hand is the author of an article appearing elsewhere in this issue.

▼

C. C. MCDERMOND has returned to Venezuela, completing his 14,000 mile air flight from Maracaibo to Alaska and back. This probably is the first time that a man has gone from the tropics to the land of eternal ice and back to the tropics in such a short space of time.

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George COLLINS, petroleum engineer of the Richmond Petroleum Company's Urumaco Camp, Venezuela, is in the United States visiting his home in California.

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Gulf's New Fleet Of River Barges

Emphasizing the growing importance of river barges for oil transportation, the Gulf Refining Company recently placed in service eight steel barges each with a capacity of 7,000 bbl. and two 5,000 bbl. barges. These barges represent the highest development of economical river transportation and contain several refinements for oil service.

Demensions of the larger barges are: 150 feet by 35 feet by 10 feet 3 inches. They are divided into eight compartments 28 feet long and are built by McClintic-Marshall on the Isherwood bracketless system under the supervision of James Kennedy, general manager of Gulf's Marine department. Two rotary cargo pumps driven from separate compartments by Buda gasoline engines are installed on each barge. Living quarters for the man in charge are placed aft.

U. S. Oil Industry Review

	Daily Production (Bbl.)	Daily Runs to Stills (Bbl.)	Gasoline Stocks (Bbl.)	IMPORTS FOR WEEK Total (Bbl.)	Gasoline (Bbl.)
Week Ending Oct. 3.....	2,147,450 381,400*	2,290,900	30,368,000	1,215,000	167,000
Week Ending Oct. 10.....	2,162,700 403,900*	2,362,100	30,516,000	1,842,000	301,000
Week Ending Oct. 17.....	2,437,000 422,150*	2,442,100	30,836,000	1,468,000	119,000

Martial Law

THE martial law situation in the Mid-Continent oil fields continued to occupy the attention of the oil industry. The possibility that it may be terminated has prevented so far further price increases in the crude and gasoline markets.

An order restraining the Texas Railroad Commission from interfering with the operation of five wells in East Texas field owned by the Brock-Lee Oil Company was granted by the Federal Judge Bryant, where upon the Governor of Texas promptly transferred the affected wells from the jurisdiction of the Railroad Commission to his own, continuing to enforce the proration allowable of 165 bbl. per well per day. From the very beginning of the martial law ruling the Governors of both Oklahoma and Texas indicated that they would yield their positions only on orders from either the President of the United States or the United States Supreme Court, hence the over-ruling of the decision of the minor Federal Court has not been unexpected. It is very likely that Brock-Lee case will be carried to the Supreme Court in order to definitely test the legality of so called proration laws, but meanwhile the production will be held under rigid proration.

Prices

CRUDE oil prices have shown little change. Some of the minor refineries have led noticeable difficulty in obtaining crude oil, more particularly in the East Texas district, although the reopening of the Oklahoma flush fields has since offered relief to refineries in Oklahoma. If the proration will continue in East Texas field crude oil prices throughout the Mid-Continent district may be increased to around $0.80 per barrel.

The gasoline markets continued slightly on the up-grade due principally to the gradual elimination of distress gasoline from East Texas. The season of diminishing demand automatically retards the increase in prices which might have been expected with more stabilized conditions in the producing branch of the oil industry.

Rusk–Gregg, East Texas

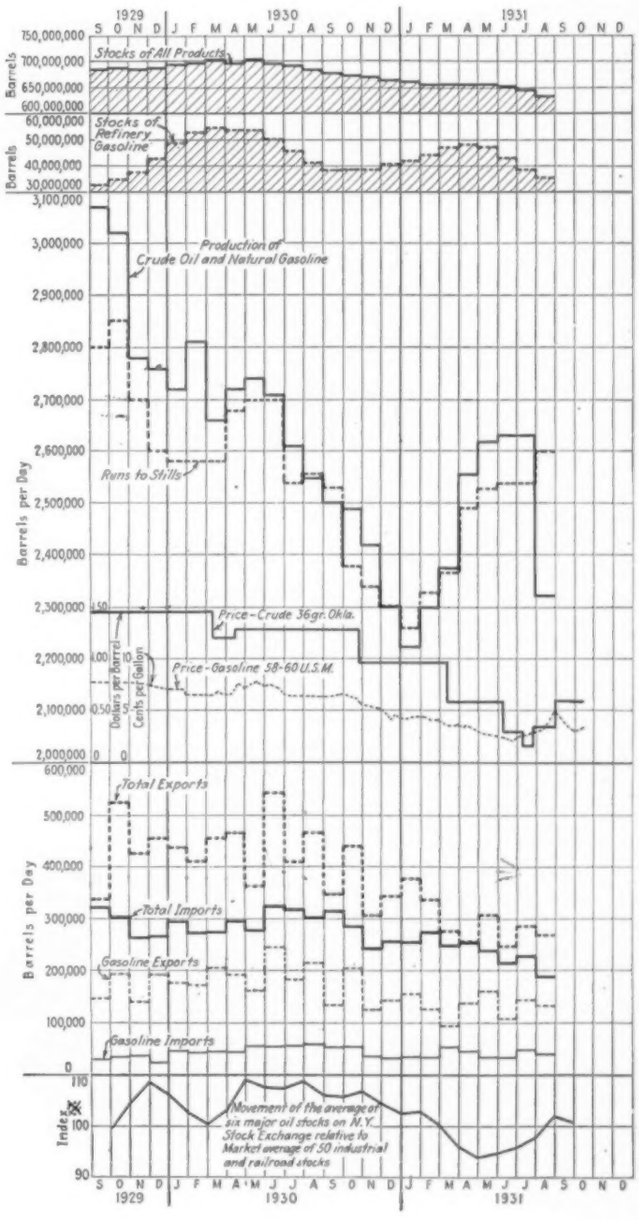
ACTIVITY in the East Texas field continued unabated, locations during the week ending October 16 numbering 136, while 125 producing wells were completed in the field. The number of producing wells reached a total of 2,400, while there are 370 drilling wells and 400 locations and rigs up. The present allowable of 165 bbl. per well will be in all probability reduced very shortly to 150 bbl. in order to keep the total production from the East Texas field within the 400,000 bbl. per day limit.

A most interesting development in the East Texas field recently has been the drilling of small diameter wells setting 3 inch casing tubing on the top of the sand, and producing around 3,650 feet, through 1¼ inch tubing. The cost of completion of such wells is around $6,000, instead of about $18,000 for the regular wells. While the proration lasts such wells are on even terms with the regularly completed holes; but they may become unprofitable, when pumping will become necessary.

Oklahoma

AS was predicted in the previous issue of the WORLD PETROIEUM the flush fields of Oklahoma were re-opened on October 10. The allowable of Oklahoma City pool has been fixed at 185,000 bbl. per day, while other flush fields were allowed 145,000 bbl., and the stripper wells in older districts 205,000 bbl., thus making up to the State's allowable of 535,000 bbl. Renewal of leasing operation has been noted in the more desirable portions of the State, and a number of wildcat tests has been projected.

BASIL B. ZAVOICO.



Statistical position of the United States petroleum industry

U. S. Soviet Russia Review

Official Figures for Operations, 1931

1931 (Month)	Crude Production (bbl.)	Crude Daily Averages (bbl.)	Runs to Stills (bbl.)	Drilling (feet)
January	12,072,900	389,448	10,399,200	168,458
February	11,141,900	397,925	9,514,400	147,935
March	12,654,600	408,213	11,197,200	226,439
April	12,318,600	410,620	10,569,300	239,699
May	12,796,000	412,774	11,841,900	236,009
June	12,989,900	432,996	11,427,500	227,307
July	13,931,400	449,400	12,248,600	228,706
August	14,066,500	453,758	11,841,200	197,257
September	13,573,490	452,449	12,185,600	205,662
Total	115,545,290	423,065	101,224,900	1,877,472
First Quarter	35,869,400	398,528	31,110,800	542,832
Second Quarter	38,104,500	418,796	33,838,700	703,015
Third Quarter	41,571,390	451,689	36,275,400	631,625

All figures converted from metric tons at seven barrels per ton.

Transportation Delays

DISORGANIZATION of transportation and lack of adequate storage facilities have slowed down progress of the Soviet oil industry. Tank farms at Baku and Grozni are filled to capacity with crude while industrial and agricultural regions of Ukraine, Caucasus, and Central Russia are short of lubricants and motor fuel. Distribution points on the Volga river, which supply the principal industrial and agricultural districts, are threatened with a shortage through the winter because of the inability of the Volga tanker fleet to deliver sufficient crude to inland refineries such as Konstantinovka and Leningrad. The fleet is also unable to handle effectively supplies from Astrakhan, largest oil terminal of the Caspian sea, at the mouth of the Volga.

Over 25,000,000 bbl. of oil are reported stored at Baku as the result of lack of storage at Astrakhan and other Volga terminals. This lack of storage space at refineries is responsible for decreased runs to stills and curtailment of production.

In addition to the above handicaps the Russian industry is still contending with a difficulty which has been mentioned before in the pages of WORLD PETROLEUM —the lack of proper equipment. At present the oil industry is attempting its great expansion program under a virtual embargo on the importation of oil equipment from abroad. The domestic industry is hardly in a position to supply equipment of the necessary quality for the strenuous use it receives in Russian oil fields.

With the exception of the Yurmes and Podolsk works of V. O. M. T. there are no special machine shops in Russia devoted exclusively to the manufacture of refinery or production equipment. Equipment manufactured at present is handled as a side line in machine shops building other types of equipment. Yurmes and Podolsk are manufacturing cracking equipment.

Drilling equipment is manufactured by the Machine Combine at Baku, Grozni, and Touapse and by the locomotive works at Sormovo, Kolomna, and Briansk. Cracking and refining equipment is turned out by the Machine Combine at Baku, Grozni, and Touapse, by the Kotlaturbina works at Taganrog, and as mentioned above by V. O. M. T. Pumps and compressors are constructed at Boretz by the Machine Combine.

A solution of this difficulty is sought in an attempt to combine all the above shops into one unit devoted exclusively to the manufacture of equipment for the oil industry. Action has become imperative with the approach of the 1932 building program which represents an increase of 240 percent over the program for 1931.

Distribution of expense and comparison of the 1931 and 1932 programs in the accompanying table emphasizes the need for a vast improvement in the organization of the Soviet machine shops devoted to the manufacture of oil equipment. The Soviets have made great progress in the development of their petroleum industry during the last two years, and no doubt will show an increase next year even if they do not accomplish their program to its full extent.

Planned Equipment Expenditures 1931 and 1932

	1932 Expenditures (roubles)	1931 Expenditures (roubles)	Increase (%)
Drilling equipment	82,000,000	30,000,000	220
Cracking & refining	54,000,000	27,000,000	200
Pumps, comprs., etc	24,000,000	10,000,000	240
Total	160,000,000	67,000,000	240

Construction

TWO pipes of an aggregate length of 375 meters, welded and tested for 90 atm. pressure, have been laid across the bed of the river Don as a link in the construction of the Armavir-Rostov/Don pipe line designed for transportation of refined products between Grozni and Ukraine. It is planned to extend the line to Moscow at a later date.

At Sakhalin, the Okha field has been connected with Moskalov oil terminal on the western shore, by an eight-inch line 30 kilometers in length which will carry crude. The new line will enable the Soviets to transport Okha crude to refineries at Vladivostok and Khabarovsk, relieving them of the necessity of disposing of this crude through the Japanese concessionaires, Kita Karafuta Kaisha.

Khabarovsk refinery, now under construction, will consist of two Winkler Koch type cracking units, treating plants, and pipe still for secondary rerun of cracked gasoline. Each unit will have a daily capacity of 4,500 bbl. fuel oil; one is expected to be in operation in May, 1932, and the other sometime in 1933. With the exception of pumps, heat exchangers, and compressors ordered in the United States, the equipment will be manufactured in Russia.

The largest unit constructed in Russia will be an installation consisting of eight cracking units each having a capacity of

3,500 bbl. per day and operating on fuel oil. The plant will also have a pipe still with a capacity of 6,000 bbl. per day for secondary rerun and a treating plant with provision for the utilization of gases.

A pipeline from the Shor-Su and Santo fields to Melnikovo and a refinery at the latter point are at present under construction and are expected to be in operation in May, 1932. The installation will consist of a Foster Wheeler type pipe still for deep fractionation and a Winkler Koch type cracking unit with a rerun and treating plant and an asphalt plant. Total operating capacity will be 3,000,000 bbl. per annum, yielding 800,000 bbl. of gasoline and ligroin, 500,000 bbl. kerosene, 500,000 bbl. Diesel oil, 700,000 bbl. fuel oil, and 200,000 bbl. asphalt. This refinery is being constructed from plans drawn by Mr. Joergenson, an American engineer in the service of the Soviet Government since 1929. Total cost of the refinery is placed at approximately 10,000,000 rbl. Petroleum products will be shipped to Russian Turkestan formerly supplied from Baku and Grozni at considerable expense for tanker transportation through the Caspian Sea.

The second furnace of the Badger pipe still, with a capacity of 14,000 bbl., has been put in operation at Grozni, bringing total capacity of the installation up to 31,500 bbl. per day. The plant yields 44 percent of the crude input, of which 21 percent is gasoline.

At Baku the Kapelushnikoff cracking unit recently installed has been converted from a liquid to a vapor phase unit yielding 33 percent gasoline from topped crude.

Col. Geo. A. Burrell, of Pittsburgh, adviser to the Grozneft oil trust, has made several suggestions for increased efficiency in operations, one of the most important being a plan to manufacture liquified petroleum gasses such as butane and protane, products hitherto unknown in Russia. Grozneft seems very likely to adopt the plan which Azneft neglected two years ago when it was suggested by H. S. Bell, petroleum technologist of New York.

Soyuzneft Reorganized

SOYUZNEFT has been dissolved and reorganized as the Petroleum Department of the Supreme Fuel Council by a decree dated September 18, 1931. The new Petroleum Department will include Oil Combines, consisting of the Azerbaidjan, Grozni, and Maikop Oil and Gas Industries, formerly the Azneft, Grozneft, and Maineft Oil Trusts: Oil Trusts, including Sakhalinneft, Vostokneft, Middleasia, Turkmanneft, Gruzneft (Georgia), Neftezavodi (plants in the interior), Zavodstroi (refinery construction trust), Neftprovodstri (pipeline construction trust), Embaneft, and Soyuznefttorg (commercial and sales department); Research Institutes, including Petroleum Research Institute, and Geological Survey Institute. S. M. Ganshin, former chairman of Soyuzneft, will head the new department reorganization which began October 1 and is expected to be completed by December 31, 1931.

J. WEGRIN.

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Book Review

Caribbean Prospects and Backgrounds, by Chester Lloyd Jones (D. Appleton and Company, New York, publisher, $4.00) is a very timely book dealing almost wholly with economic and social factors in the progress of the Caribbean region and its relations with the United States.

Mr. Jones's volume will be of interest to those in the petroleum industry for a number of reasons. The comprehensive study of the resources and economic development of the region and that of the character of the local populations as to race, education, industry and buying power are valuable to all those who are interested in pushing the expansion of American foreign trade and to those who undertake to solve the problems which must be met in launching and carrying on Caribbean developmental enterprises.

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World Oil Production Figures--Official

All figures furnished direct to World Petroleum by Governments, except where otherwise specified

(Conversion ratio 7 bbl. = 1 ton)

	Total 1930 (revised) (barrels)	1st 6 mos. 1931 (barrels)	JAN. (barrels)	FEB. (barrels)	MARCH (barrels)	APRIL (barrels)	MAY (barrels)	JUNE (barrles)	JULY (barrels)	AUGUST (barrels)	SEPT. (barrels)	Daily Aver. Jan.-Sept. (barrels)
United States	898,011,000	421,392,000	65,991,000	60,645,000	69,375,000	73,101,000	77,164,000	75,116,000	77,961,000	74,831,000	61,500,000[1]	2,328,512
Venezuela	141,652,832	60,025,709	10,579,707	9,806,034	10,705,814	9,579,784	9,834,545	9,519,825	10,339,028	10,133,319	9,703,736	330,409
Russia & Sakhalin	129,955,417	73,973,900	12,072,900	11,141,900	12,654,600	12,318,600	12,796,000	12,989,900	13,941,400	14,066,500	13,573,490	474,274
Persia[2]	43,549,323	21,659,481	3,201,156	3,079,132	3,081,260	3,442,341	4,296,642	4,558,950	4,404,106	4,434,507	4,627,525	128,665
Roumania	39,876,589	23,694,930	4,233,810	3,570,000	3,856,020	3,850,000	4,195,100	3,990,000	4,046,000	3,886,680	3,886,000[1]	130,086
Mexico	39,529,639	17,076,457	2,890,903	2,563,986	2,819,430	2,761,039	3,080,603	2,960,496	3,129,042	2,841,438	2,628,227	94,049
Dutch East Indies	38,722,250	16,952,992	3,226,854	3,225,000	2,625,285	2,625,285	2,625,284	2,625,284	2,750,000[1]	3,000,000[1]	2,601,482	92,690
Colombia	20,343,176	9,380,050	1,657,694	1,565,425	1,774,865	1,467,429	1,479,452	1,435,185	1,490,524	1,512,528	1,414,958	50,542
Peru	12,455,888	4,969,945	986,902	662,022	1,131,155	914,342	762,624	512,900	1,005,712	793,677	692,200	27,332
Trinidad	9,418,907	4,824,997	831,552	744,518	844,534	798,134	788,528	817,761	842,884	891,908	832,483	27,078
Argentina	9,001,671	5,505,965	898,007	796,578	875,400	833,700	1,038,780	1,063,500	1,022,900	1,031,100	988,100	31,228
India (British)	6,936,315	3,689,933	662,604	635,743	705,568	553,912	563,126	568,980	570,000[1]	570,000[1]	570,000[1]	19,780
Sarawak	5,251,541	1,778,295	369,852	231,090	355,453	309,876	302,295	293,151	288,806	283,563	239,302	9,853
Poland	4,645,550	2,209,455	390,600	350,700	381,500	357,000	372,155	357,500	377,300	374,997	360,500	12,169
Japan & Taiwan[1]	2,250,000	1,172,500	197,500	195,900	195,000	195,000	195,000	195,000	195,000	195,000	195,000	6,438
Egypt	1,977,660	979,093	196,021	158,210	162,225	160,573	152,418	149,646	143,311	146,468	144,431	5,177
Ecuador	1,596,238	835,561	137,531	120,145	126,544	117,763	169,111	164,467	177,085	168,228	162,488	4,701
Canada	1,535,827	954,101	179,711	155,651	160,358	153,705	156,392	148,284	119,327	133,014	101,435	4,791
Germany	1,209,185	596,194	127,894	98,000	100,030	77,833	95,438	96,999	97,390	107,616	99,484	3,301
Iraq	980,000[4]	600,000[1]	100,000[1]	100,000[1]	100,000[1]	100,000[1]	100,000[1]	100,000[1]	100,000[1]	100,000[1]	100,000	3,297
France	516,642	240,225[1]	40,075[3]	40,075[3]	40,075[3]	40,000[1]	40,000[1]	40,000[1]	40,000[1]	40,000[1]	40,000[1]	1,320
Czecho-Slovakia and others	220,000	164,700	25,900	25,900	25,900	29,000	29,000	29,000	29,000	29,000	29,000	952
Total	1,409,635,650	673,676,483	108,988,143	99,910,109	112,096,016	113,786,316	120,236,493	117,732,828	123,060,355	119,570,543	104,489,841	3,735,789

[1] Estimates. [2] Anglo-Persian Company's figures. [3] Official total, 1st quarter 120,225. [4] Actual production in Iraq probably higher than official total.

Roumanian Oil Resumé

BUCAREST, October.

STATISTICS recently compiled, dealing with Roumania's exports of petroleum products, reveal two important trends: the low proportion of fuel oil to total exports in relation to the amount produced, and the very considerable increase in total exports which, coupled with price reactions, indicates the extent of Roumania's dumping activities.

Exports of fuel oil represent only about 20 percent of total petroleum exports from Roumania compared with a ratio of approximately 50 percent to the total yield. Unlike other products, Roumanian fuel oil is experiencing difficulty in finding new markets, and stocks in the country have doubled recently constituting a danger to the normal work of Roumanian refineries, some of the largest of which are threatened with stoppage on account of the increasing stocks of fuel oil.

In connection with the question of dumping, the fact that Roumanian prices of late have remained consistently below Gulf prices, refusing to respond even to a stiffening of Gulf prices, indicates that a large section of the Roumanian oil industry is endeavoring to make up for the decreased prices by an increased quantity of exports. Not only is this policy affecting Europe in spite of the general belief that it is detrimental to the price structure but, as reported in WORLD PETROLEUM, Roumanian oil is beginning to invade the United States by way of the Sunny Service Oil Company of Detroit.

The Astra-Romana is loosing no opportunity of forcibly expressing its antagonism to the policy of overproduction resulting in underselling world markets in an effort to acquire new export outlets. The company asserts that the failure of the policy is clearly demonstrated by the deplorable condition of the petroleum industry in Roumania.

The Roumanian Government is expected to take over shares of the Steaua Romana, now held by leading Roumanian banks, in spite of the heavy loss such action would entail for Government and taxpayers.

Comparative Roumanian Exports First Half 1930 and 1931

Product	January-June 1930 (barrels)	January-June 1931 (barrels)
Gasoline	3,810,667	5,734,946
Kerosene	2,846,228	3,609,081
Gas oil	1,679,601	2,271,143
Lubricants	261,730	226,408
Fuel oil	3,428,057	3,645,873
Crude oil	131,719	282,688
Totals	12,158,002	15,770,139
Paraffin (tons)	671	2,380
Other products (tons)	...	4,886
Total, all products in tons	1,737,657	2,260,143

The shares in question had been passed over to a Swiss concern organized for that purpose directly after the war. Roumanian banks, however, counting on an improvment in the value of the currency under the Averscu Government took them from the Swiss concern. When the appreciation in the leu failed to materialize, acquisition of the shares proved disastrous to the banks, a situation which the Liberal Government of 1924 attempted to relieve by turning over without cost to the Steaua Romana several hundred hectars of the best state reserve oil lands. Unfortunately the banks were not enabled to pay out of the profits of this deal the loss incurred by the acquisition of the Steaua Romana shares, as the Government had planned.

E. I. MARGULIUS.

General view of the Borgslaw oil field of Poland.

Mexican Oil Activities

Tax Revenue

WHILE the Federal Government's revenues from petroleum production and exportation taxes showed a remarkable increase in August, compared with its income from these sources in July, the August yield from gasoline production was much lower than that for the previous month, according to figures of the special taxation department of the Ministry of Finance. These data show that August petroleum taxes amounted to 826,653.62 pesos (about $275,550, U. S.), of which 538,911.79 pesos were derived from production and 287,740.83 pesos from exportation. The total July petroleum levies revenue was 197,394.64 pesos.

Receipts from August gasoline production taxes totaled 1,107,092.80 pesos (some $369,030), compared with the 1,474,046.63 pesos derived from this source in July, the department's figures show.

MEXICO'S sales of petroleum and gasoline to Brazil were cited by Adelardo Rocas, Brazilian ambassador to Mexico, and Enrique L. Soto, member of the Federal Chamber of Deputies from a flourishing Vera Cruz state coffee region, in the controversy that has arisen regarding impending large shipments of Brazilian coffee to Mexico. Ambassador Rocas, in a statement to the Mexico City press in which he called the quarantine against coffee that was ordered at the instigation of Soto as a means of protecting domestic production, unjust. The diplomat advised Mexico to remember that Brazil is one of her best customers for petroleum and gasoline, and pointed out that during 1930, his country bought 59,044,784 kgs. of gasoline and 19,053,224 kgs. of petroleum from Mexico, and hinted at possible retaliatory measures against this country.

REFERING to figures revealing the steady decrease in Mexico's petroleum production from 1921, the year of maximum output for this country, and the fact that the Republic has dropped from second to sixth place among world petroleum producing countries, the Department of National Statistics remarks that this steady reduction of production is not to be construed as indicating that the nation's oil resources are diminishing. The Department contends that Mexico is still rich in petroleum, and argues that the reduction refers only to production due to curtailment of activities by the companies and the world economic depression.

OFFICIALS of California Standard both in Mexico City and Los Angeles, when interviewed by representatives of WORLD PETROLEUM, denied the rumor, expressed in a leading Mexico City daily, to the effect that their company through its subsidiary, Richmond Oil Company of Mexico, contemplates spending some $20,000,000 on production and, in addition, constructing a refinery in Mexico City.

DOUGLAS GRAHAME.

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Imperial Oil's Lake and River Tanker

DEVELOPMENT of the Great Lakes and river fleet of the Imperial Oil Limited of Toronto, Canada, dates back to 1902 when the first tanker was placed in service. Additions were made from time to time until 1930, during which year four modern craft were placed in service including two on the Ottawa river between Montreal and Ottawa.

The fleet today comprises the following vessels:

Name	Date Completed	Capacity
Imperial	1902	.....
Incoma	1912	15,000 bbl.
Impoco No. 2	1913	25,000 bbl.
Imperoyal	1913	25,000 bbl.
Icolite	1916	20,000 bbl.
Royalite	1916	20,000 bbl.
Sarnolite	1916	20,000 bbl.
Talaralite	1918	29,000 bbl.
Windsolite	1927	21,000 bbl.
Acadialite	1930	21,000 bbl.
Simcolite	1930	21,000 bbl.
Ottawalite	1930	6,000 bbl.
Rideaulite	1930	6,000 bbl.

There were two other tankers, the Impoco No. 1 and the Reginolite. One was sunk by the enemy during the war and the other was sold.

The two Ottawa river tankers, one of which is the subject of our frontispiece this month, were built in England, are steam-driven craft of 600 i.hp. at 108 r.p.m., and have a loaded speed of 8½ knots on a daily fuel consumption of 53 bbl. Their loaded displacement is 1,583 tons on 11 foot 1¼ inch mean draft, or 1,266 tons on nine foot draft.

In their 118½ mile trip between Montreal and Ottawa they transit the Lachine, Carillon and Greenvale canals, passing through 13 locks. At their loading and discharging ports the approximate turn around is six hours.

Simcolite, one of the Imperial Oil Company's new Ottawa river tankers.

FINANCE

New York—October

DURING the first few days of October the market declined to new lows, partially at least as a result of further liquidation following the suspension of gold payments by England. This movement ended, however, with one of the sharpest rallies on record on October 6, reflecting the stimulation of confidence afforded by the announcement of President Hoover's plan for the mobilization of bank credit. The oil shares likewise made new lows in the period covered by this month's tabulation, but closed somewhat above the bottom. The industry is now entering its poorest season of the year, but has the advantage of enjoying somewhat better prices for its products than prevailed during the summer months. The refining branch now has the opportunity to so conduct its operations during the coming two months as to enter the 1932 gasoline season in a strong statistical position, which would allow much better prices and profits than were obtained this year. Crude output appears to be well controlled for the present.

BECAUSE of inability to agree on mutually satisfactory terms, Sinclair and Tide Water Associated have abandoned merger negotiations, and it is understood that announcement of a definite plan to consolidate Sinclair, Prairie Oil and Gas, and Prairie Pipe Line will be forthcoming in the near future. One of the greatest stumbling blocks in the way of agreement is said to have been the determination of a satisfactory basis for taking care of the Tide Water Associated preferred stock.

Sinclair reported consolidated net loss for the six months ended June 30, 1931, of $10,415,088 after all charges, compared with a profit of $3,251,709 earned in the first half of 1930.

IN order to relieve cases of distress, where employes are in danger of losing shares previously acquired or now being purchased, Standard Oil Company (New Jersey) is offering to members of the third employes stock acquisition plan the privilege of borrowing up to $25 a share on stock standing to their credit but not to be delivered to them until the termination of the plan at the close of the year. A number of important American corporations have taken steps recently to afford some sort of relief to employes who have been participating in stock purchase plans, which in many cases have involved buying the shares at substantially higher prices than have prevailed recently in the open market.

UNION OIL COMPANY of California reported consolidated earnings for the September quarter equal to 30 cents a share on 4,386,070 shares, compared with 2 cents a share in the second quarter and 41 cents in the first. For the nine months net was approximately $3,200,000 after all charges, equal to 73 cents a share. In the same period of 1930, $1.84 a share was shown. Although these earnings were only half of the $1.50 cash dividend requirements for the period, dividends were continued without in any way impairing cash position, since the amount of bookkeeping charges deducted from earnings was more than equal to the deficiency.

ARTHUR G. M'KEE AND COMPANY, consulting and contracting engineers of Cleveland, Ohio, who have designed and supervised many important refinery projects in the oil industry, reported profits for the first nine months of this year of $462,630 after all charges, equal to $5.48 per share of common stock. In the same period of 1930 earnings were $453,998, equal to $5.38 per share. Ratio of current assets to current liabilities on September 30 was 12-to-1, with cash and equivalent of $833,745 constituting by far the major portion of the total current assets of $1,161,919. The current dividend rate is $3.50 per share per annum.

Officials of the McKee company report that its foreign business continues in satisfactory volume despite conditions in Europe and South America and with good prospects for additional business in these fields. During the third quarter there was a decided increase in domestic business and inquiries, and all business was taken at close prices.

LIKE all other speculative markets, oil shares have had a big shake-up, with higher prices on balance, during the past few weeks. If the abandonment of

New York Stock Prices

1931 High	1931 Low	Current Div. $ per Annum	Stock (Par Value $)	Sales (Shares)	September 21 to October 17 First	High	Low	Last	Net Change[1]
23⅝	9½	1.00	Atlantic Refining (25)	98,900	12⅜	13¼	9½	12¼	— ⅝
14½	4¾	....	Barnsdall "A" (25)	126,700	5	6½	4⅜	6	— ⅞
3⅛	¾	....	Colon Oil (No)	17,800	1	1⅛	¾	⅞	— ⅛
12	5	....	Continental Oil (No)	151,400	6½	7¾	5⅜	6¾	.....
3⅞	1⅜	....	Creole Petroleum (No)	34,700	2	2⅛	1⅝	1⅞	— ⅛
75½	38	1.50	Gulf Oil Corp. (25)	65,100	42½	50	38	45⅝	+1⅝
72	47¾	2.00	Humble Oil & Ref. (25)	26,800	49⅞	55	47¾	47¾	—2⅛
18¼	7⅜	0.50	Imperial Oil, Ltd. (No)	95,200	9½	10¼	7⅜	9	—1½
4⅝	1⅜	....	Indian Refining (10)	8,600	2½	2½	1⅝	2½	.....
15½	7¾	1.00	International Petr. (No)	146,600	9¾	10¼	7¾	9¼	— ⅜
19½	6½	....	Ohio Oil (No)	100,700	7½	8¾	6½	8	+ ¼
36½	20	*0.80	Pan Amer. P. & T."B"(50)	2,200	28	28	20	22	—8
16⅝	4¾	....	Phillips Petr. (No)	116,800	5¾	7	5	6	.....
20¼	5½	....	Prairie Oil & Gas (25)	25,400	7¾	8⅞	5½	7⅛	—1
11⅞	5	....	Pure Oil (25)	65,300	6	6⅞	5	5¾	— ⅜
6¾	⅜	....	Richfield Oil (No)	10,200	1	1¼	⅞	1¼	.....
42⅝	13½	‡2.27	Royal Dutch N. Y. (13⅓)	34,000	13¾	20¾	13½	19¼	+5¼
20¾	5½	....	Seaboard Oil (No)	135,400	9	10⅞	5½	8	—2
10¼	3¼	....	Shell Union (No)	88,000	4	4⅞	3¼	4⅜	+ ⅛
15⅞	5½	....	Sinclair Consol. (No)	263,500	7	8	5½	7	— ⅛
12¾	3½	....	Skelly Oil (25)	8,600	4¼	5⅛	3½	4⅛	— ⅛
21	12½	....	Socony-Vacuum (25)	316,800	14½	16⅞	12½	14	—1
51¾	28⅛	‡2.50	Standard Oil of Calif. (No)	180,600	32⅞	34⅝	28⅛	31⅜	—1⅞
38½	15⅞	1.00	Standard Oil, Ind. (25)	199,100	21½	21½	15⅞	20	—1⅞
23⅝	13¼	1.60	Standard Oil, Ky. (10)	48,100	16	16¾	13¼	15⅝	— ⅝
52½	28¼	§2.00	Standard Oil, N. J. (25)	464,500	31½	34½	28¼	32	—1⅜
45¼	26¾	#1.00	Sun Oil (No)	29,900	30	36	26¾	31⅛	+1⅛
36¼	15	2.00	Texas Corp. (25)	191,000	19	20⅜	15	18¼	—1¾
9	3½	....	Tide Water Assoc. (No)	100,300	4	5⅛	3½	3¾	— ⅜
26⅝	11¾	*2.00	Union Oil of Calif. (25)	53,900	13	16¼	11¾	15⅝	+1½
1⅞	⅜	....	Venezuelan Petr. (5)	11,500	⅝	⅝	⅜	⅜	— ⅛

[1] Since close of last month's table. * Paid so far this year. † Paid for 1930—no regular rate. ‡ Also paid 2 percent in stock at close of 1930. § Including extras. # Also paid 9 percent in stock at close of 1930. ★ Plus 4 percent in stock.

the gold standard in Britain has done nothing else, it has at least broken the condition of stalemate that previously existed in the Stock Market. The rapid rise in oil shares following the cessation of gold payments certainly appeared justified by the reduced value of sterling, as well as by the fact that the soundest shares had just previously fallen to low levels which appeared to overdiscount the unfavorable factors in the industry itself. The announcement by the leading distributing companies in Great Britain that they were co-operating, indicating as it did that prices of petrol and other products would be kept down as far as possible, tended to discourage hope of larger sterling profits, and rather indicated the reverse.

Up to the present, the market has stood up to recent adversities very well, and has shown a distinct tendency to improve whenever their weight has been temporarily lifted. The principal reason for firmness is a small but fairly continuous demand for the better class oil shares from the British investing public, which has recently seen how quickly share prices can advance when conditions are really favorable to such a movement. The present floating supply of shares is small, and the speculative position existing when cash transactions became compulsory is, of course being gradually eliminated. But it is doubtful if present price levels will be maintained in the absence of a further fall in sterling or definitely better news of the world oil situation.

BY halving the interim dividend rate for the current year, Burmah Oil directors disappointed the market, but the subsequent setback in the shares has not been very severe. Dealers had been talking of a distribution of 7½ percent, despite the many factors in the present situation making for caution on the part of oil company directorates. In the circumstances, the payment of an interim of 5 percent, against 10 percent a year ago, may be considered a good performance. For the whole of last year, the dividend was 22½ percent, compared with 30 percent for 1929. The company is a big holder of Anglo-Persian and Shell Transport shares, and the final dividends from these investments for 1930 will come into the Burmah accounts for 1931. Reductions of dividend by both companies will reduce Burmah's current earnings, which have probably been affected, in addition, by the continued difficulty of the market in India, where the company finds a large outlet for its products. The position in this respect has not improved since June last, when Sir John Cargill, presiding at the Burmah meeting, indicated that the demand for products was shrinking under the economic distress of the Indian people.

APEX (Trinidad) Oilfields appears likely to provide an example of low selling quotations being partly offset by increased output. Production for the year to September 30, 1931 established a new high record for the company. The total of 3,654,000 bbl. was 679,000 bbl. in advance of that for 1928-29, while deliveries rose from 2,982,000 bbl. to 3,619,000 bbl. All the company's output of crude is sold under contract to Trinidad Leaseholds, which has its own refinery in Trinidad and distributing organization in the British market. But, the company has already felt the pinch of low prices, for total dividends were reduced from 52½ percent in 1928-29 to 25 percent in the following year. The interim this year was 7½ percent, and the market hopes, too optimistically perhaps, for a similar final payment, making a total return of 15 percent.

ANNOUNCEMENT by the British Mexican Petroleum Company that it will pay off all its outstanding 5½ percent ten-year bonds in March, 1932 foreshadows the disappearance of the last vestige of British interest in the Agwi companies. The bonds, of which there are just over £700,000 outstanding, were issued in 1925 in exchange for shares of the Agwi Petroleum and Agwi Oil Marketing concerns — two undertakings which were never successful under British proprietorship. Through British Mexican Petroleum, Anglo-American Oil, and Standard Oil Export Corporation, the ultimate control of Agwi now rests with Standard Oil Company (New Jersey).

MANY industrial companies which might this year celebrate their golden jubilees have been so severely affected by the depression that they can find little cause for rejoicing at this time. Although subject to the same influences, the International Paint and Compositions Company, Ltd., finds satisfaction in its long record of successful growth and in the maintenance of its strong world-wide position in its field. Established at Newcastle-on-Tyne in 1881 under the name of M. Holzapfel and Company, it is now one of the leading companies in the ships' paint business. Some year ago it expanded its sphere of operations to include paints and varnishes of all classes and for all purposes. Large quantities of steel and iron containers for paints, oils, etc., are also manufactured.

The issued capital of the company is £734,500, divided into 200,000 shares of 6 percent cumulative preference stock and 534,500 ordinary shares, both of £1 par value. Due to the company's consistent conservative policies over a period of years there are substantial reserves, and for the year ended December 31, 1930, earnings were equal to 8½ times the 6 percent preference dividend requirements, and 12 percent was paid on the ordinary shares.

ALEC H. DAY

London Stock Exchange Prices

1931 High	1931 Low	Last Year's Div. % per Ann.	Share	September 15 to October 15 First	High	Low	Last	Change
9/16	1/4	3½	Anglo-Ecuadorian	1/4	5/16	1/4	5/16	+ 1/16
2 3/16	1 1/16	17½	Anglo-Egyptian "B"	1 3/16	1 5/16	1 1/16	1 1/16	+ 1/16
2 15/16	1 3/16	15	Anglo-Persian	1 1/16	2 1/16	1 1/16	1 15/16	+ 7/16
5/8	9/16	25	Apex Trinidad (5s.)	5/8	7/16	5/8	7/16	+ 1/16
31/32	7/16	....	Attock	5/8	11/16	7/16	9/16	— 1/16
5/16	1/8	5*	Brit. Borneo (6s.)	1/16	1/16	1/16	1/16	.....
7/16	5/16	6¾	Brit. Burmah (8s.)	5/16	5/16	5/16	5/16	— 1/16
5/16	1/16	....	Brit. Controlled ($5)	1/16	3/16	1/16	1/16	.....
1/4	1/16	....	Brit. Controlled Pfd. ($5)	3/16	1/8	1/8	1/8	.....
3⅜	1 11/16	22½	Burmah	1 7/16	2 3/16	1 11/16	2 1/16	+ 5/16
15/16	7/16	12c.	Canadian Eagle (No par)	9/16	5/8	7/16	½	— 1/16
11/16	3/8	....	Creole (No par)	7/16	½	13/32	7/16	.....
3/16	1/16	....	Kern River (10s.)	1/16	3/16	1/16	3/16	+ 1/16
1¾	11/16	10	Lobitos	¾	1 1/16	11/16	27/32	+ 3/32
17/32	9/32	6	Mexican Eagle ($4 Mex.)	5/16	11/32	9/32	5/16	.....
36½	24¾	40c.	Pan American "B" ($50)	26	33	25	26	.....
3/8	1/4	2½	Phoenix	5/16	3/8	5/16	7/16	+ 1/16
26 1/16	9¾	17	Royal Dutch (fl. 100)	12¾	17¾	9¾	13¾	+3
3 27/32	1 15/32	17½*	Shell Transport	1¾	2¾	1 15/32	2 1/16	+ 5/16
9/16	5/16	4	Steaua Romana	7/32	3/8	5/16	7/16	.....
1 15/32	⅜	7½	Trinidad Leasehold	⅜	1 5/16	29/32	1 1/16	+ 5/16
9/16	3/8	....	Untd. Brit. of Trinidad (6s.8d.)	5/16	3/8	3/8	⅜	— 1/16
1 25/32	29/32	17½	Venezuelan Oil Concessions	15/16	1 1/16	29/32	1 1/16	+ 5/16

Nominal value of shares £1 unless otherwise stated by bracketed figures.
* Denotes Tax-free dividend. c. Denotes cent per share.

Paris—October

ALL the finishing touches were put to the edifice which has been laboriously erected during the last few years by the directors of the Compagnie Française des Pétroles and the French State, when the shareholders of the company ratified their agreements with the State on September 30 last, and voted an increase in capital of Fr. 110,492,500 by the issue of 220,985—500 franc shares.

This sum, which will bring the companies' capital up to Fr. 315,692,500, amounts to 35 percent of the total and is entirely reserved for the State to subscribe to. Sixteen thousand seven hundred and seventy new A shares and 240,215 new B shares will be issued at par and will have to be entirely paid for on subscription. The State will have the option of taking up all, or part, of the shares through the medium of the O. N. C. L. (Office National des Combustibles Liquides). The ratification of the increased capital was briefly reported on page 578 of the October issue of WORLD PETROLEUM.

This increase in the C. F. P.'s capital in no way interferes with the authorization conferred upon the board of directors by article six of the companies' statutes enabling them to decide a further augmentation, at their own discretion, if the occasion demands it. The shareholders maintained paragraph six, extended the capital limit of Fr. 600,000,000 to Fr. 650,000,000 and modified their statutes accordingly.

The president of the company, Colonel E. Mercier, stated in his speech that the C. F. P. will now have to execute its joint programme with the Iraq Petroleum Company in Mesopotamia on the one hand, and with the Compagnie Française de Raffinage in France on the other; that is to say it will have to take its full share in the creation and development of the refining industry in this country, but he added in the same breath that in times as difficult as these, it was the duty of those in whose hands the responsibility of tracing a working programme lay, not to undertake more than it was financially possible to realize.

Mr. Mercier also informed the shareholders that with the help of the Government representatives a plan of campaign had been elaborated which had been so carefully studied that he hoped the company would not find it necessary to increase its capital at all during 1932 and that despite this fact there would be no slowing down in the accomplishment of the task it had set itself to do.

AFTER a prolonged struggle to try and recover some degree of prosperity, the S. de Pétroles de Dabrowa has, at last, been obliged to wind up its affairs. This decision was taken at the last extraordinary share holders meeting held on September 25 after losses of Fr. 168,950,281 had been announced for the financial year ended October 31, 1930. These losses, it may be added, were partly caused by depreciation of the S. de Pétroles de Malopolska's shares of which Dabrowa held the majority.

Dabrowa's present position is unenviable: liabilities amount to Fr. 240,000,000 whereas assets (represented by 450,000 Malopolska shares valued at Fr. 0.20 cts. each) only total Fr. 9,000,000. The results of Dabrowa's liquidation will therefore greatly depend upon the results of the negotiations which have been undertaken for the financial reorganization of the S. des Pétroles de Malopolska.

EFFECTS of continued price wars are beginning to make themselves felt on the French market and some of the weaker oil companies, unable to stand the strain of prolonged undercutting any longer, are gradually being eradicated.

For some time past the S. Commerciale des Carburants a small distributing organization has been in trouble, and has called a shareholders meeting for October 15 in order to wind up the business. Losses for 1930 exceed Fr. 2,580,000 which added to those of the previous years (Fr. 4,286,804) make a total of Fr. 6,867,429.

NAFTA, S. A. Pour L'Exploitation du Petrole, a Belgian concern, originally founded with the aim of working certain oil concessions in Roumania, is now more of a holding company, and has large interests in the following companies: Petrofina, Purfina Concordia, Creditul Carbonifer, Cie. du Congo Belge, etc. This year a dividend of Fr. 6.- was paid to capital shares and Fr. 25.- to participating shares, after Fr. 1,238,001 had been put aside for amortization of the joint account.

Gross profits for 1930 totaled Fr. (Belgian) 4,516,577; administrative and working expenses cost the company, Fr. 182,09, which left a net profit of Fr. 4,333,977.

PENDING the introduction of 4,068,000 Astra Romana shares of Lei 500 each on the Paris Bourse on September 21 a good many rumors were circulated concerning the company's alleged merger in Roumania with the Romana Americana.

These rumors were quite unfounded but were circulated doubtless with the aim of giving added attraction to the shares about to be introduced on the market.

In reality, Astra Romana's shares hardly need to be bolstered up. It is one of the most powerful international organizations in Roumania (representing Royal Dutch interests) and although the company has suffered from overproduction, reduced prices and Russian competition, like all other companies, it paid a dividend of 6 percent for the last financial year, and net profits amounted to Lei 484,320,399 as compared with Lei 303,821,243 the previous year.

E. J. ANDRE.

Paris Bourse Prices

1931 Div.	Share	September 19 to October 13 First	High	Low	Last	Change	Position on Oct. 13, 1930
30 Lei	Astra Romana	57	66	45	49	—8	140
....	Colombia	51	52	39	40	—11	110
30 Lei	Concordia	42	44	36	39	—3	96
....	Cdré. Gén. des Pétroles act	....	....	....	....	....	....
....	Cdré. Gén. des Pétroles part	....	....	....	....	....	....
....	Franco Pol. Pétroles act	46	46	30	38	—8	100
....	Franco Pol. des Pétroles part	....	....	....	....	....	351
1 $	Franco Wyoming	195	195	161	161	—34	415
20 Fr.	S. G. des Huiles de Pétrole act	230	230	186	191	—39	498
....	" " " part	....	....	....	....	....	221
....	C. Française des Pétroles	....	....	....	....	....	....
....	C. Industrielle des Pétroles	750	770	708	708	—42	960
45 Fr.	Lille Bonnières Colombes prio	590	605	552	592	+2	980
20 Fr.	" " " ord	420	435	400	416	—4	650
....	Malopolska act	18	20	12	17	—1	....
....	Malopolska part	83	90	67	74	—9	1770
3 $	Mexican Eagle	40	42	35	39	—1	58
....	Omnium Inter. des Pétroles	90	91	77	....	....	141
50	Pechelbronn	495	502	385	385	—110	870
60 Fr. B.	Petrofina	400	410	370	380	—20	527
170 Fl.	Royal Dutch	13700	15000	12000	15000	+1300	34200
17 Fl.	Royal Dutch 1/10	1400	1525	1335	1525	+125	3435
5 Sh.	Shell	205	220	199	216	+11	508
....	Steaua Française	151	161	139	153	+2	176

Canadian Petroleum Industry

MONTREAL, October.

CURTAILMENT of output in United States fields has resulted in some advances in prices of crude in Canada. Mid-continent oil, delivered at Sarnia, advanced 19.8 cents per barrel, and domestic crude advanced 15 cents per barrel at the same delivery point during August.

August imports were generally higher than July. Crude reaching 106,065,392 Imperial gal. as compared with 98,145,089 in the previous month. Gasoline imports were 11,108,657 gal. compared with 7,407,336 gal. in July, and 16,480,758 gal. in August of 1930. The effects of the tariff on gasoline can be traced in the comparison of 1931 figures with those of 1930.

It is too early to assess the effects of the depreciation of the Canadian dollar upon imports; but it seems reasonable to expect further declines in imports of gasoline, other than those attributable to seasonal influences, as a result.

General business conditions have inevitably affected the marketing and distribution of petroleum products. A section of marketing conditions across the country discloses regional irregularities. Thus the prairie provinces, which have suffered severely through economic and climatic conditions, show a heavier falling off than other parts of the country, and present the zone of greatest weakness from the distribution viewpoint. Those domestic companies whose service is nationwide are feeling general conditions more keenly than those distributors whose field of activity is confined to the eastern and extreme western provinces. General retail prices continue to hold fairly steady, though some price cutting is manifested in the western provinces.

The immediate outlook is somewhat obscure. Business remains quite; but extensive constructional programmes on the parts of the Federal and Provincial Governments for the relief of the unemployment situation present a bright spot, and these should provide some business for oil companies.

R. C. ROWE.

London Market Report

SINCE our report of last month we have been witnessing exciting times occasioned by the rates of exchange question.

The mineral oil market has, of course, been very much affected; but so far, this has resulted in the increase in price of lubricating oil only—from 5/- to as much as, in some cases, £3/-/- per ton. Up to the present there have not been any changes in the prices of motor spirit, kerosene, gas oil and fuel oil.

MOTOR SPIRIT: Wholesale prices, delivered in bulk, are as follows:

	Aviation	No. 1	No. 3
England, Wales and South Scotland	1/7½	1/3½	1/1½
Belfast Zone	1/8	1/4	1/2
Rest of Nothern Ireland	1/8½	1/4½	1/2½
North Scotland	1/8½	1/4½	1/2½
Dublin Zone	1/3½	11½	9½
Rest of Irish Free State	1/4½	1/-½	10½

Wholesale prices in two-gallon cans: Aviation and No. 1; ld, and No. 3; 1½d per gallon above bulk prices except in Irish Free State and Northern Ireland where they are 2d per gallon more.

KEROSENE: Water white 8½d per gallon, and standard white 7½d per gallon, in bulk, for London and home counties. Rest of England and Wales ½d per gallon more. Barrelled oil ex wharf 3d per gallon above bulk prices for both qualities.

GAS OIL: In rail tank car loads, i.e. 10 ton lots 3¼d per gallon, and in smaller quantities of 1,000 gallons and upwards 3½d per gallon, net and naked, ex wharf.

LUBRICATING OILS: Current market prices are as follows: American pales £10/-/- to £22/10/-, American reds £11/2/6d to £17/5/-, American dark cylinders £10/2/6d to £25/-/-, and American filtered cylinders £19/-/- to £30/5/- per ton, less 2½ percent, barrels free, ex wharf.

FUEL OILS: Furnace fuel oil £3/7/6d per ton, in bulk, ex ocean installation, for inland consumption, for bunkers the price is the same, i.e. £3/7/6d per ton. Diesel fuel oil £4/-/- per ton, in bulk, ex ocean installation, for inland consumption, for bunkers the price is 2/6d per ton dearer, i.e. £4/2/6d per ton.

For contracts — furnace fuel oil £3/2/6d, and Diesel fuel oil £3/15/- per ton.

The foregoing information was supplied by Benjamin and Company of London.

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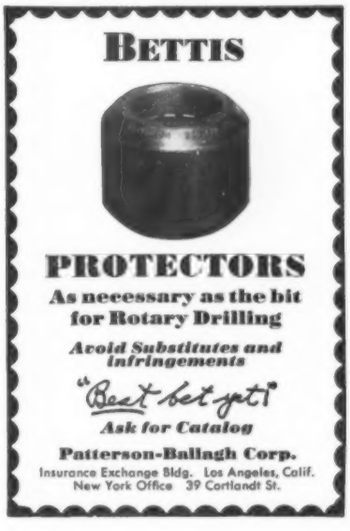
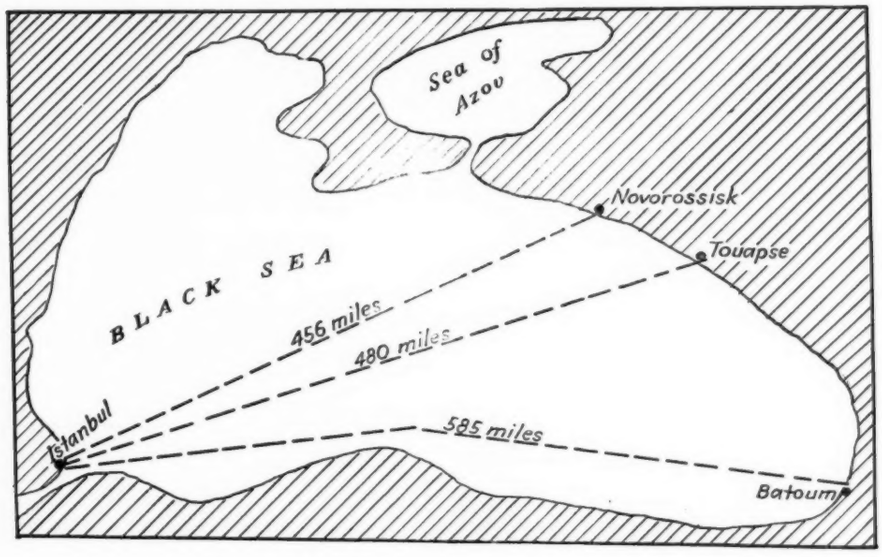
A BILL providing for a special import tax of one cent a gallon on crude oil and two cents a gallon on gas oil and similar grades, has been passed by the Government of San Domingo.



THE RUSSIAN OIL PRODUCTS OF SOYOUZNEFTEEXPORT



EXAMPLES OF DISTANCES FROM NOVOROSSISK TO LEADING PORTS

Port Said	1247 miles	London	3574 miles
Bombay	4293 miles	Hamburg	3881 miles
Genoa	1768 miles	Rotterdam	3630 miles

PERFECT **quality of the various petroleum products obtained from the high-grade oils of Bacou, Grozny and Maikop, and the *low* freights from the Black Sea ports—Batum, Touapse and Novorossisk—especially to the markets of Europe, East Africa and Asia Minor, are the *two* main reasons for their wide *distribution*.**

REPRESENTATIVES OF THE SOYOUZNEFTEEXPORT (MOSCOW)

ENGLAND . . "Russian Oil Products, Ltd."

GERMANY—"Deutsch-Russische Naphta G.m.b.H." (Derunapht)
"Derop" Deutsche Vertriebs-Gesellschaft für russische Oelprodukte, A.G.

FRANCE . . . "Société des Produits du Naphte Russe."

ITALY . . . . . Societa Anonima Italiana "Petrolea."

SWEDEN . . . Aktiebolaget Naftasyndikat.

also Companies and Representatives in

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